

TWENTY-EIGHTH ANNUAL REPORT

January 1, 1938 to December 31, 1938

Northern Rocky Mountain Forest and Range Experiment Station
Missoula, Montana

U. S. Department of Agriculture
Forest Service

NORTHERN ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

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THE RESEARCH ACTIVITIES OF THE STATION

GENERAL

The Northern Rocky Mountain region has a wealth of those natural resources, forests, range forage, and water, in the conservation of which the Forester is most concerned. Out of a gross land area for the region of 110 million acres, 34 million acres are classified as forest land, 61 million acres as pasture and range lands, 12 million acres as crop lands in farms, and 3 million acres as farmsteads, roads, urban, and waste lands. Forest, pasture, and range lands make up 95 million acres, or 85 percent, of the gross land area. This is the reason why livestock and timber production are the two industries upon which much of the development and prosperity of the region have been based. The headwaters of the Missouri, the Yellowstone, and the Upper Columbia River are all within the region making the water conservation and use problem an important one. The protection, proper management, and best use of these great natural resources in such a manner as to contribute most to the social and economic security of the dependent population are the important problems within this region with which research must be concerned.

The protection of the forest and range resource from losses by fire, drought, insects, and disease has long been one of the most important jobs within this region. The work of this Station in helping to solve the problems of forest fire control have been outstanding. The fire records for this region during the past few years are clear evidence that the efficiency of control action has been greatly improved

by use of these research results. The work is by no means completed. Numerous parts of the problem are unsolved or only partially solved. The next new and major step needed is in the field of the economics of fire control. Efficiency has been improved. Costs must now be reduced. The harmonization and adoption of silvicultural methods with fire, insect, and disease protection requirements is a large field offering much promise for useful and concrete accomplishments that has been scarcely touched in this region. For example, careful studies must be made to evolve practical regeneration methods which will not only produce the economically desirable white pine but will not complicate, even perhaps assist, blister rust control. Preliminary work along this line was initiated in cooperation with the Blister Rust Control Office during 1938. The effects of the recent severe drought upon the eastern Montana ranges is being studied and recommendations for the grazing practices necessary to facilitate recovery are being evolved. The danger of restocking faster than range recovery is being recognized in some quarters. A very large acreage of unplowed but drought depleted range may have to be artificially reseeded for recovery in any reasonable time. The Western Range Survey project played an important part in the identification of such areas. Research to determine the best methods for insect control has not yet been undertaken by this Station.

"Genuine Idaho" white pine, most famous of the lumber producing trees, has probably been the cause of more of the complex problems that confront the lumbermen, the foresters, and the people of the region.

Station is to develop the proper methods and procedures for growing,

than any other one factor. Since early in the present century white pine has been the motive for an activity in forest exploitation far beyond the ordinary development that would have occurred had this famous species not been present. White pine has been the backbone of forest enterprise from the days of pioneer settlers to the present time. It is practically the only one of the lumber species within this region that can compete in the large market centers of the country with the lumber products from districts more favorably located because of nearness and lower transportation costs. As a result, remote forest areas have been opened up which, if it were not for the white pine, would have remained inaccessible to profitable conversion for many years to come. Communities have been established in districts where the lumber industry is and can be the only means of livelihood. Tree by tree, the valuable white pine has been cut and each year more and more stands composed of species which cannot be handled profitably are left behind. Cutting of the virgin forest in some districts has gone forward at such a rate that sustained yield management under the present mill setup is already impossible. The economic and social welfare of many of these forest communities is seriously threatened. White pine does not always reproduce satisfactorily under residual stands and the supplies of this species are being constantly depleted. Susceptible to fire, blister rust, and insects, a heavy annual toll is taken by these agencies. Control and regeneration measures are improving but much remains to be done to increase their efficiency. The justification for much of the research at the Northern Rocky Mountain Forest and Range Experiment Station is to develop the proper methods and procedures for growing,

protecting, and utilizing a satisfactory and stable supply of white pine so that the benefits resulting from this species can be continued without interruption. Considerable progress has been made towards the solution of the white pine problem. A 289-page manuscript on natural regeneration in the western white pine type has been submitted for publication as a technical bulletin. This publication will fill a long-felt need for a general and comprehensive presentation of available information on natural regeneration problems in this type collected during 25 years of research and nearly 30 years of National Forest timber cutting practices. Forest products records of a statistical nature have been compiled for many years. Data on the production, consumption, distribution, cost and selling value of white pine products have been collected and analyzed. Woods and mill utilization practices have been studied and much valuable data on the general utilization and economic situation within the industry collected. Surprisingly little is known of the regeneration and growth of the species associated with western white pine in the type. Utilization of these so-called secondary species is at present the dominant silvicultural and economic problem in the management of the western white pine type. Funds are needed to initiate a new project for the purpose of studying the financial aspects of forestry in the white pine type of northern Idaho.

If a profitable market for all of the other timber species of this region existed optimum silviculture could be practiced on all forest lands. Such is not the case, however. New uses and improvements in present utilization of many of our species must be found before optimum silviculture will be possible. There is, therefore, a very

close tie-up between silvical research and forest products and economic investigations at this Station. Although the most pressing needs have been and still are in the western white pine type, other forest types in the region should be studied.

According to the estimate above, there are some 61 million acres of pasture and range lands within the Northern Rocky Mountain region. Certain of the acreage classified as forest land is suitable for the grazing of livestock so the total land area available for range and pasture use may be somewhat more than the 61 million acres. Discontinuance of the cooperative Western Range Survey project through lack of funds makes impossible an accurate estimate of the range resources of the region. The proper management of these range lands presents as many serious obstacles and problems as do that of the forest lands of the region. Grazing management studies are under way in the shortgrass ranges in eastern Montana and recommended practices based upon the results obtained will have a decided bearing upon the proper management of such ranges. Some outstanding results have already been obtained. A 40-50 page summary of four years' data from the Miles City Experimental Range entitled "Drought a Decisive But Underrated Factor in Range Management Practices" will be submitted for publication early in 1939. Due to limited personnel and finances little work as yet has been done on grazing management studies in the spring-fall and high summer ranges of the region.

The major function of the Northern Rocky Mountain Forest Experiment Station is to conduct research in connection with the problems dealing with the protection, proper management, and development

of the Restoration of a grass cover on several million acres of plowed and abandoned and of overgrazed range lands in the Great Plains area of eastern Montana is recognized as one of the most necessary and urgent rehabilitation jobs. Most of the land falling within this class is still in private ownership but is rapidly going into county hands through tax delinquency. There is an urgent demand for dependable data as to the best species and mixtures, and for inexpensive methods with which to guide the efforts of various public agencies and the thousands of private land owners in their efforts to restore the productivity of these range lands. These problems are being studied and the recommendations proposed are being put into practice with more than usual success. The plantings have been generally successful and enthusiasm for this form of range rehabilitation is rapidly rising. Much work still remains to be done on species, methods, and site factors. A program to develop field stations and test centers to provide for forage plant breeding and adaptation tests is also needed.

The Forest Survey project, now approximately half completed for the region as a whole, will, when completed, furnish the necessary basic information for the development of intelligent plans for the management of the timber resources and for the use of this forest land as a part of a broad land-use policy. The Western Range Survey project, now inactive, would have furnished like information for the development of intelligent plans for the management of the range resources.

The major function of the Northern Rocky Mountain Forest and Range Experiment Station is to continue to assist in the solution of the problems dealing with the protection, proper management, and best use

of the region's forest, range, and water resources. Within the limits of its finances and facilities, it is carrying on a number of projects to obtain specific information towards that end. These projects, together with the Forest Survey, have been underway for the past year and for several years before. The needs of the Station seem to lie, for the present at least, not so much in the initiation of new projects or the invasion of new fields, but in building up the five major research divisions already established. Many problems in range, fire, forest management, and forest products and utilization research are still unsolved. Adequate financing on a regular basis of the Divisions of Products, Fire, Forest Management, Forest Survey, and Range Research is absolutely necessary if the Station is to redeem its responsibility as the foremost research organization within the region. The appropriation of additional funds for new lines of research work will not alleviate the acute situation now present in some of the Divisions. The urgent need for study in forest influences and in forest and range economics is fully recognized, however, and sufficient funds to carry a qualified man in each of these three lines of work would be advisable, even for the present.

The Station entered the present fiscal year with less funds than in any year since F.Y. 1934. Except for \$12,000 of CCC research funds, and a \$3500 ERA allotment, the Station is operating on its regular budget. With this in mind, the accomplishments during the past year are presented.

The program during the past year has been a varied one. It has been divided about equally between a continuation and rounding out of going studies and the initiation of new studies of short duration.

SILVICULTURE

The future of the timber industries in the Northern Rocky Mountain region depends largely upon the manner in which the forests of the region are managed. Successful management is, in the main, the practice of sound silviculture, which, in turn, rests squarely upon a thorough knowledge of the silvical characteristics and requirements of all the tree species making up those forests. Silvicultural research is dedicated to obtaining this basic knowledge.

Silvicultural research of more than a quarter of a century has already provided the basis for sound silviculture in the major forest type of the region. It has answered the most pressing questions concerning methods of cutting, natural regeneration, volume, growth and yield, planting, and stand improvement. It has made a start toward a better knowledge of the silvical requirements of individual species.

The Division has concentrated its efforts during the past year, as in former years, to the western white pine forests. This is as it should be; these forests are not only the mainstay of the timber industry of the region but they are the most complex as well. It is here that the most pressing silvicultural problems are presented and it is here that the greatest benefits are reaped from research.

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Field work for a type-wide study of increment and mortality following logging in western white pine stands has been rounded out during the past summer with the completion of a special study of mortality in such stands. The data obtained, together with information gathered in 1937, and additional data from a series of permanent sample plots in cutover stands, and from an unpublished cutover area study by Haig in 1928, will form the basis for a comprehensive report on growth in partially cut stands of the western white pine type. Compilation and analysis of the data have already been partially completed; preliminary results show that growth approximately balances mortality during the first decade following logging while during the second decade, with decreased mortality and a slightly increased increment rate, substantial net growth is made. The results of this study point the way to a more intelligent and successful application of partial cutting methods to the type.

A better evaluation of stand improvement measures now in use in the region to improve rate and quality of tree growth has been made possible, by a survey, financed out of CCC funds, of regional stand improvement projects. In cooperation with the Region, the Station initiated the job of assembling data on each project in uniform and usable form. An especially important part of the work has been the collection of data showing stand conditions before and after treatment; these are essential to get a measure of the real value of each project, especially in the years to come. Unit reports are being prepared for each project and a summary report covering all projects will be written. All will aid in gaining a better perspective of stand improvement measures and will assist in orienting future research in this important field.

Field work and part of the analysis have been completed for an economic analysis of silvicultural practices in the western white pine type, built around the North Fork of the Coeur d'Alene River in the Coeur d'Alene National Forest of northern Idaho as a case unit. The study will attempt to arrive at a relative evaluation of the various practices through a critical analysis of values and costs of each. It should help materially in making a rational appraisal of research priorities and in developing a sound research program.

Northwile results were obtained from a preliminary study of root rots of western white pine conducted cooperatively by the Station, the Coeur d'Alene Forest Insects Laboratory of the Bureau of Entomology and Plant Quarantine, and the School of Forestry, University of Idaho. The study yielded information on the incidence and development of shoestring root rot, caused by Armillaria mellea, on white pine in selected areas, the relation of the fungus to bark beetle attack, and some further knowledge of the nature and habits of the fungus on white pine. A forward step has thus been taken in determining the status of this much talked about disease and its relation to silvicultural practice.

Gratifying progress has been made in forestation studies, financed out of CCC funds. The Station has continued to concentrate on direct seeding. Three species, western white pine, ponderosa pine, and Engelmann spruce, were seeded on four different sites in both the spring and fall. These tests have already shown that, given protection from rodents, direct seedings promise to be successful. A limited number of commercial rodent repellents were tested and found to be ineffective. A large-scale test of the use of poison to protect the seeded areas has been started. Seed-

ings of Engelmann spruce were successful without protection from rodents. Tests of western red cedar were begun to determine if this species, like Engelmann spruce, may tend to be immune from rodent depredations. Direct seeding offers definite promise as a useful adjunct to planting in the reforestation program of the Region.

Cooperation, consisting of advice and some field help, was extended to the Regional Office of Planting in their five-year study of class-of-stock and carefulness-of-planting studies. An outstanding find of these studies has been that extra care in handling and planting young trees, not ordinarily used by planting crews, resulted in 20 percent higher survival. The Station completed an analysis of all available plantation records and prepared a report for publication. This analysis brought out several interesting facts, the most noteworthy of which is that on all plantations in Region One made between 1910 and 1937, aggregating 93,900 acres, average survival 10 years after planting was only 42 percent.

Development of an arboretum at the Priest River Experimental Forest has gone steadily forward during the past year. It now occupies an area of approximately 100 acres and contains 45 blocks of coniferous species, each block of such size that it will be a forest stand. The area will be of increasing value for demonstration and education.

The two experimental forests, Deception Creek and Priest River, have continued their usefulness as centers for research and demonstration of timber management practices. General development and silviculture work has gone forward on both forests as in the past. A tentative timber management plan was developed for the Deception Creek Forest, and a preliminary silvicultural and timber sale program was worked out for the

Priest River Forest.

Plans for 1939, as in the past few years, call first for a completion of all manuscripts covering completed studies. The Division has the objective of making research results available to all interested persons and agencies with the minimum of elapsed time between the completion of each study and the publication of the results; it will continue with this objective. The major manuscript to be prepared is that dealing with growth and mortality following partial cutting in western white pine stands; its completion and publication will round out a series of publications on silviculture in the white pine type. A number of other manuscripts are in the process of preparation. The work schedule of the Division will also include the following: (1) Maintenance of permanent sample plot records for longtime experiments. Some of these plots, especially certain thinning plots, have now been established long enough to yield indicative results. The data from these will be analyzed and the information prepared for publication. (2) Completion of the economic analysis of silvicultural practices of the western white pine type. (3) Completion of the survey of stand improvement projects. (4) Continuation of a study of reproduction development. (5) Continuation of forestation work in the field of direct seeding, a work of very real value to the Region and which calls for a full-time man financed from regular appropriations instead of from the present uncertain emergency funds.

FIRE RESEARCH

Since fire research was originated in this Region in 1922, marked progress has been made in acquiring new knowledge and in developing new methods to improve the efficiency of fire control. Naturally, the first attack was on the most obvious problems or difficulties of fire control; efficiency has been improved. Costs have now been reduced.

(1) the accurate estimation of prevailing fire danger; and (2) what to do

This vital question of justifiable cost of forest protection is on the forests to meet more successfully each of the many degrees of danger. Fire danger measurements, the fire danger meter, and the rating of being applied. For example, forest areas bearing high timber values, danger on a numerical scale have been evolved to materially reduce the comprising highly valued recreational area, and in addition forming the first difficulty. Fire control planning methods, involving detailed headwaters of streams heavily utilized either for irrigation or municipal surveys and inventories of the fuels that burn, their probability of water supply or both, accordingly forming such greater expense to insure ignition, the detection of these fires, and smokechaser, and crew attack, successful fire control than on small areas bearing sub-optimal tree growth, have been developed and applied with obvious benefit to the second problem. seldom visited by recreationists, but where water runoff already is well

The fire records for this Region during the past few years are controlled by nature of the ground or the existence of impending lakes. clear evidence that the efficiency of control action has been greatly improved by use of these research results. In 1938, a season of only a beyond which further fire control expense is definitely warranted for little less than average danger due to weather, and with 1,373 fires or the former, high-value areas, no principles exist today to guide the slightly more than the normal number occurring, only 100 acres were forester in determining how little effort and expense should be expended burned per million acres protected. This equals the best record ever on noncommercial, little used, low-value areas. The same criterion of before attained in this Region, even under the extremely favorable climatic conditions of 1912, when the records show that summer rains were the day following discovery. more favorable than they ever have been since. While other developments,

Obviously, this economic question should be considered even before principally in organization and training, the use of CCC's, etc., also any definite fire control policies are established. It was to apply contributed to this marked improvement of the fire record, the use of wherever and as soon as fire danger measurements and fire control planning are even contemplated. These activities cost money. They can be major causes.

Many improvements still can be made in existing danger measurement and fire control planning methods, and research to produce these improvements should be vigorously prosecuted. The next new and major step needed, however, is clearly in the field of the economics of fire control. Efficiency has been improved. Costs must now be reduced.

This vital question of justifiable cost of forest protection is intimately associated with land-use planning, as that technology is now being applied. For example, forest areas bearing high timber values, comprising highly valued recreational use, and in addition forming the headwaters of streams heavily utilized either for irrigation or municipal water supply or both, undoubtedly justify much greater expense to insure successful fire control than do equal areas bearing sub-alpine tree growth, seldom visited by recreationists, and whose water run-off already is well controlled by nature of the ground or the existence of impounding lakes.

While the law of diminishing returns exerts an ascertainable point beyond which further fire control expense is definitely unwarranted for the former, high-value areas, no principles exist today to guide the forester in determining how little effort and expense should be expended on noncommercial, little used, low-value areas. The same criterion of satisfactory fire control is applied on both today - control by 10 a.m. the day following discovery.

Obviously, this economic question should be considered even before any definite fire control policies are established. It begins to apply wherever and as soon as fire danger measurements and fire control planning are even contemplated. These activities cost money. They can be

applied in various intensities at more or less cost. Their costs, as well as those for fire prevention, detection, and suppression, undoubtedly should be held to the minimum for low value, unimportant forest areas. The limit of no further commensurate returns should be reached only on the highest valued areas. The immediate, basic need is, therefore, to commence those forms of research in the economics of forest land management which will produce principles distinguishing the relative justification and cost of protection for any forest area. Clearly, this is a nationwide problem, but a beginning must be made in some particular region. As fire danger measurement and fire control planning are more advanced in Region One than in any other region of the Forest Service, and as further refinement and application of these methods depends now largely upon silvical and social-economic differences within this region, the essential social-economic research should be commenced here.

One marked reason for commencing such work as soon as possible is emphasized by the tendency of the last few years to evolve a specific method for determining both the total appropriation of funds needed by the Forest Service for fire control, and the sub-allotment of this fund to the respective regions. At present, both the regional and country-wide needs are determined of necessity by personal judgment. With the total amounting to some ten million dollars it is rather obvious that every defensible device of good business management, good engineering, and good statistics should be used. It is possible that twice, or even three times, the present total allotment is justifiable, and it is

possible that based upon thorough social-economic research the present total or even less is all that can be justified. If the latter is true then further improvement in the fire record will be clearly recognized as contingent upon improved efficiency alone. Such a conclusion would most certainly result in a reduction of effort and expense on the least valuable areas in order to liberate funds for those more valuable but not yet satisfactorily protected. The localized social-economic research results would then be essential to show where such reduction should be made.

Such reduction or redistribution would also immediately reemphasize the need for further refinement in danger measurement and fire control planning methods, in order to increase efficiency. It is therefore obvious that these two research projects should be prosecuted with increased vigor since their results are essential in every respect.

The plans for the calendar year 1938 called for a bare continuation of the work as curtailed in 1937. Two reports were prepared, however, on the basis of data already collected which, when published, will add considerably to the knowledge of fire control planning and fire behavior. The reports submitted for publication were "Hornby's Principles of Fire Control Planning" and "The Effect of Certain Chemical Attributes of Vegetation on Forest Inflammability." Records for a fourth season were collected and the preparation of a report on variations of certain fire danger factors with altitude and aspect were well under way.

During 1939 a statistical analysis will be made of the fire danger ratings 1934-1938, inclusive, on ten forests to determine seasonal curves of normal, worst probable, and least probable fire danger as a basis for fire control planning and financing. Work will also be started on a "fire behavior meter" and a "fire dispatchers guide." Further check will also be made to determine whether the present fire danger meter should be further modified for most dependable use in eastern Montana.

Intensive checking of rates of spread of fire and rates of held-line construction is urgently needed to improve the basis of fuel type classification. Some 10,000 fire reports have been punch carded and work will be started on their analysis to determine (a) effects of improved facilities, manpower, and methods resulting from past planning, and (b) additional improvements and changes possible and needed to increase efficiency and decrease costs.

The Logging and **FOREST PRODUCTS RESEARCH** Station have resulted

The present Forest Products Research program deals largely with the economic problems of the timber owners of Montana, northern Idaho, and northeastern Washington. As the work was directly under the Regional Forester from 1907 until 1931 the needs of the administrative branch of the Forest Service received the greatest emphasis. The common everyday needs of the Regional Forester required accurate information on (a) the rate forests were being cut; (b) the amount of wood products produced; (c) wood requirements of local industries; (d) trends in selling values and production costs of the various timber products; (e) woods and mill

utilization practices and a multitude of other general utilization and economical data pertaining to forest management. These data, historical and current, are now being furnished to the operating divisions of the U. S. Forest Service of Region One and other forest owners of the Northern Rocky Mountain Region.

In the solution of the more perplexing utilization problems a liaison is maintained with the Forest Products Laboratory at Madison, Wisconsin. For example, a recent demand developed for factual data on decay resistance of the various color phases of heartwood of western red cedar. Are the various lighter color phases of cedar heartwood suitable for shingles, railroad ties, or telephone poles? In the fundamental research on physical properties of wood required in such a study the services, facilities, and expert advice of the Forest Products Laboratory are available.

The logging and milling studies of this Station have resulted in a substantial improvement in forest practice on both public and private forest lands. On public lands, particularly the National Forests, clear cutting has given way to a considerable extent to lighter cuts in which the economics of the situation are considered along with the silvicultural requirements of the stand. On private lands, application of the price economics of the situation to cutting methods has resulted in better forest practice. Two of the largest operators in the Inland Empire are leaving, as a residual stand, all trees below the minimum profitable sized limit established by studies. This results in many control program, these questions and many others are asked. What is

the annual payroll of North Idaho is in a much higher state of thousands of acres of cutover land being left in a much higher state of many wage earners and dependents. The productivity of the forest is in a much higher state of productivity than formerly and in shape to produce a second cut 30 to 50 years sooner, than if cut under the old system.

Better forest management results not only from better methods of cutting but also from better methods of utilization. Service tests to determine the durability of wood for different uses help hold as well as extend the profitable market for wood, thereby justifying practice of more scientific cutting methods. Cooperation with the Northern Pacific Railway has resulted in definite knowledge of the service life of local cross tie species. In 1907, when this company's first treating plant began operating, their replacements averaged 346 ties per mile of track annually; in 1937 only 129 ties were used to do practically the same job. Thirty years ago, their average service life for ties was 9 years; today it is about 23 years.

Other forest products records of a statistical nature have been compiled for many years. Data on the production, consumption, distribution, cost and selling value of forest products, are all indispensable in the intelligent analysis of the social and economic future of our communities dependent upon forest enterprises. Citizens of a certain state of continuous productivity is centered upon two large concerns who own or control practically three-fourths of the remaining merchantable timber. They must know the trend of past lumber production to predict the future life of their payrolls. Likewise, certain forest management practices are proposed wherein the public has a great stake. A case in point is blister rust control. In justifying the expenditures of a necessary control program, these questions and many others are asked. What is

the annual payroll of North Idaho mills dependent upon white pine? How many wage earners and dependents do they support? Forest Products statistics supply the answers without delay.

If a profitable market for all timber species of this region existed optimum silviculture could be practiced on all forest lands. However, such is not the case. New uses and improvements in present utilization of many of our species must be found before optimum silviculture will be possible. Today lumbermen and foresters of the Northern Rocky Mountain region are wondering what to do with the 20 billion feet of merchantable western larch. Larch is a species intrinsically valuable for lumber and the richest species chemically of all western conifers. Very little of it is sold outside this sparsely settled and little industrialized Northern Rocky Mountain region because of lack of markets. New methods of chemical utilization and better methods of manufacture and marketing of larch as lumber would provide new payrolls that are badly needed.

Not only are new payrolls needed but stability of existing forest industry payrolls by maintenance of forest land productivity is important. In western Montana the maintenance of private forest lands in a state of continuous productivity is centered upon two large concerns who own or control practically three-fourths of the remaining merchantable timber. One of these operators now cuts approximately 25 million feet of mining timbers, principally from small trees (11 to 16 inches in size) which, under good forest practice, should be left as a basis for the next cut. It is possible that this mining timber requirement

can be supplied from square timbers sawn from larger trees. This possibility should be studied. There also remains more than 7 billion feet of lodgepole pine on the east slopes of the Rockies in Montana that could be utilized for mining timbers if research would point out new and improved methods of logging and transportation.

The Products research program for 1939 will continue the aforementioned statistics work and complete a report started the past year on the status and results of wood service tests. In the timber harvesting and conversion series of studies it is planned to continue work on (1) investigation of the use of second-growth (65-year-old) western white pine for matches; (2) application of principles of selective cutting (tree and area) developed to date in logging and milling studies to a 600-acre white pine area on the Deception Creek Experimental Forest; and (3) testing of various power saws to determine adaptability to logging practice. If time permits and personnel is available, two new studies will be included in the series. Possibilities of the substitution of squared (sawn) mining timbers for round material will be studied in addition to application of the principles of selective cutting in ponderosa pine to a tract on the Trapper Creek Experimental Forest.

RANGE RESEARCH

It is gratifying to note an upward trend through 1938 on drought stricken short-grass ranges which have declined alarmingly in density since 1933. The past year, as a whole, had a precipitation deficiency of only about 14 percent of the long-time average at Miles City but the

and 4.0 cents per pound of waste, half weight for the intermediate spring months were very favorable for range recovery. A greatly thinned stand of perennial plants that survived the long drought thickened up very greatly but few seedlings survived the hot, dry weather of late summer. It is still a question how many years will be required to rebuild the present stand, now only about 25 percent of the 1933 level. Abnormal height growth did something to make up the deficit in density. Drought will doubtless continue as a major handicap in range management. All data point to the need for a very conservative rate of restocking these ranges depleted of both livestock and reserve forage.

The great variability of range production, large areas involved, and inherent difficulties of reliable measurements give rise to unusual difficulties in experimentation. Better methods are of basic importance to sound progress in range research. The progress of this Station has been retarded by our inability to find a man with suitable experience and qualifications to push this work. Satisfactory progress is dependent on improved methodology and this phase of range research should be stressed accordingly.

While methods for comparing response of vegetation to different treatments are still unsatisfactory as mentioned above, valuable data were obtained in 1938 from both the cattle and sheep range phases of the cooperative shortgrass management project at the U. S. Range Livestock Experiment Station. The cumulative calf crop for five years now stands at 73, 84, and 80 percent for overgrazed, moderately grazed, and lightly grazed pastures. Feed costs for both cows and calves for the five-year period, including extreme drought years of 1934 and 1936, are 5.4, 3.7,

and 4.0 cents per pound of weaning calf weight for the intensities mentioned above. Moderate to light grazing then is a real advantage, even during severe drought which kills a large percent of the vegetation at all intensities impartially. Results from sheep phase of this project carried for three seasons are not yet so significant due largely to shorter period of time and to difficulties of getting satisfactory distribution of sheep in their pastures and too few sheep to stock pastures to their planned intensities. Progress was made in the distribution problem last season and more sheep are assured for 1939. Additional data that should contribute when fully analyzed to the development of utilization standards were collected on both cattle and sheep ranges at Miles City.

It is inadvisable to divert funds needed at Miles City for work on summer ranges at Vigilante. Consequently, but limited research work was accomplished by one man at the latter point though he did collect plot data on seasonal development of certain plants, some utilization correspondingly. Aside from more skillful management and balance of data, and he supervised installation of water facilities and some other native forage resources, revegetation is the most promising means of improvement work. The test of downy brome grass range at the winter horse range near Perma was continued through the second season. This range has carried horses in fairly satisfactory condition for two seasons at the average rate of 1.6 acres per horse month, which indicates that downy brome is a valuable range forage even though the objective in management should be to replace it with more dependable perennial forage such as crested wheatgrass.

That a major change has been in progress in the organization and use of western ranch lands is indicated by the trend away from small ranch units toward an increase in numbers and size of those of 1,000 acres and larger. The acreage in the 100-174 acre size units declined sharply during the period 1910-1930, while the number of ranch units of 1,000 acres, or more, more than doubled and the total acres in such units more than trebled. This trend has doubtless been greatly accelerated in many range areas during recent drought years. The reduction in population and number of home units has reached alarming proportions in places. Greater unit productivity is the one way to check further reductions in home units on range areas without reducing living standards to an unacceptable level.

Traditional advantage of low cost production of livestock on western ranges threatens to be lost unless present low productivity of these ranges can be built up without increasing operating expenses correspondingly. Aside from more skillful management and balance of native forage resources, revegetation is the most promising means of maintaining the competitive position of the western range states in livestock production. Depleted ranges, as well as those that have always produced low yields because of soil or climatic conditions, should be included in a comprehensive program of range revegetation. For this reason, the introduction as well as the breeding, improvement, and adaptation of new forage plants should be included in such a program. Tremendous strides made during recent years in improving field crops and yields indicate that an adequately financed and manned

research program might produce corresponding results in improving range vegetation and productivity in proper relation to costs and national economy. The three forage nurseries established last year and plans for more detailed revegetation research are steps in the right direction but fall far short of the actual needs. Recommendations for a more adequate program of research directed at increased range production by methods that will check the tendency toward higher production costs and dwindling population dependent on western ranges are included later.

The proper use of approximately 65 million acres of range in this region and the stability and welfare of thousands of ranch homes depend, to a considerable extent, on a judicious balance in use of range resources and products of irrigated and other crop lands. As a result of recent drought years and previous mistakes through unwise efforts to dry-farm range lands, major adjustments back to range livestock are in progress. Old practices must be revised and new ones developed in range and livestock management to meet present conditions and keep the best balance of range and harvested feeds; to evaluate marketing practices of range livestock; to determine the proper size of a home ranch for various conditions; to avoid the handicap of owning submarginal land, etc. Maintaining the proper balance between cost and returns requires that all the foregoing points must be fully weighed. A program of research in range economics is required for this region for guidance toward more stable social and economic home building and land use on Montana ranges. Field work on the inventory phase of the Survey was begun in 1932. Since that time the entire forest land area in the three north-

FOREST SURVEY

The forests of the Northern Rocky Mountain region differ today from those of yesterday and likewise they will be changed tomorrow or a year from now to the extent that they will have grown and been depleted in the interim. Continuing in the same vein, it is equally true that the consumption of timber products in this region is constantly changing also as the result of many and varied causes. To meet the increasingly pressing need for basic statistics concerning the forest resources and the factors influencing the management of these resources, the Forest Survey organization of this Station has been charged with the twofold task of collecting the vast amount of information needed in connection with this large forest region, and with keeping these data adjusted periodically.

The first of these tasks involves by far the larger amount of work, and in the seven years of activity since the beginning in 1932 the efforts of this organization have been almost entirely concentrated in making the original coverage and compiling the first comprehensive record ever obtained for the region. However, with this work only partially completed, it has already been necessary to make some revisions of the statistics compiled in earlier years.

The basic data being gathered may be divided in five separate fields: (1) Forest Inventory; (2) Growth; (3) Depletion by logging, fire, insects, and disease; (4) Requirements or consumption of timber products; and (5) Economic Factors. These several phases are in various stages of completion.

Field work on the Inventory phase of the Survey was begun in 1932. Since that time the entire forest land area in the three north-

eastern Washington counties (2,644 MM acres) and the ten North Idaho counties (10,330 MM acres) has been inventoried and mapped. In western Montana 9 million out of a total of around 12 million acres of forest land have been inventoried and mapped in the field. No field work has been done on the estimated 11 million acres of forest land in this work is increasing.

It will be seen that of the 36 million acres of forest land within the Northern Rocky Mountain region, 22 million acres, or 61 percent, have been covered in the field. In the heavily forested counties of the region the entire land area has been mapped so that actually the inventory covers some 25 million acres of gross land area. The field inventory and mapping, however, are but a part of the complete inventory job. Preliminary data must be collected and checked, the field data tabulated and compiled, the maps prepared for release, and the forest resource figures obtained published in county reports. The entire inventory job has been completed for the North Idaho and north-eastern Washington units and the 13 county statistical reports have been published. Six of these reports were released in 1938. Two-inch-to-the-mile township plat type maps and one-inch-to-the-mile unit (40 townships per unit) have been released for 18 million of the 25 million acres of gross land area covered to date. The degree of completion for all phases of the inventory, based on the ratio of the area mapped to the total regional forest area to be covered, was 49 percent as of January 1, 1939. The degree of completion was raised 8 percent during the past year. Other work not reflected in the progress of the inventory during the past year consisted of the recompilation and retabulation of the type

Rocky Mtn. 34 million acres

application factors which make it possible to use the normal yield tables and volume data in more complete and comprehensive form for the North Idaho for predicting growth of undisturbed stands with a reasonable degree of unit report. Some time has also been spent by the inventory organization on accuracy. Based on these studies, the following table of normal yield the recompilation and tabulation of type and volume data for certain of the table application factors not approved for Forest Survey use. major watersheds for use of other departments and agencies. The amount of this work is increasing.

Although it has been necessary to begin the work of keeping the Inventory statistics up to date, this project has been limited in its scope due to the fact that funds do not allow the assignment of any field personnel to the task of reexamining the areas which have been logged, burned, or otherwise depleted since the type mapping was originally done. Through the cooperation of the fire organizations of the State Forester's Office, and the Idaho National Forests, it has been possible to collect a *fairly* complete record of all public and private areas cut in northern Idaho.

As logging has wrought much change in the stands of several Idaho counties, the original estimates of these counties were revised on the basis of the records received. Present plans include the continuing of this record for northern Idaho and obtaining the same type of data for northeastern Washington and western Montana. A fire record is also being maintained currently for the entire Inland Empire. However, it has not yet been necessary to make revisions for this type of drain as the recent fire damage has been small in those areas for which statistics have been released.

Outstanding accomplishment of the Growth phase during the past year was the development of growth correction factors for the white pine and associated types. Analysis of the field data collected furnished

will soon be ready for publication.

application factors which made it possible to use the normal yield tables for predicting growth of understocked stands with a reasonable degree of accuracy. Based on these studies, the following table of normal yield table application factors was approved for Forest Survey use.

Normal yield table growth reduction factors			
Type	Board feet	Cubic feet	Basic table used
	Percent	Percent	
White pine	75	85	White pine normal yield table
White fir-hemlock	70	80	do
Spruce	70	80	do
Cedar	50	60	do
Cedar-white fir	50	60	do
Larch-Douglas fir	70	80	Larch-Douglas fir normal yield table
Douglas fir	70	80	do
Lodgepole pine	50	60	Lodgepole pine normal yield table
Ponderosa pine	60	70	Ponderosa pine yield table

The cedar pole growth study was completed in the field in October 1938. One major product of the study was a check of the applicability of the form class taper curves which was developed at the outset of the study to facilitate accurate estimate of pole lengths. These checks show the curves to apply equally well to poles wherever found in this region. Applied Forestry Note No. 88, entitled "Taking the Guess Out of Cedar Pole Inventories" describes in detail the application of this method of estimating lengths of cedar poles and shows the checks that were made throughout the region. Analysis of cedar increment data has brought out the outstanding fact that in stands of less than sawlog size, i.e., seedling and sapling and pole stands, there are approximately 800 M poles now standing which are of merchantable size. A report of this study will soon be ready for publication.

Compilation of current annual growth statistics for North Idaho is about 80 percent complete. This shows that there are growing annually in North Idaho 702 million board feet of timber, of which approximately 300 million board feet are white pine. The current annual growth estimates have been completed for the northeastern Washington unit. The Growth and Yield phase of the Forest Survey for the region as a whole may be considered as about 50 percent complete.

The original project of compiling and publishing estimates of the annual production of the various timber products was completed in 1937. These data were published as Forest Survey Progress Report No. 1, "Cutting Depletion in the Northern Rocky Mountain Region" and released finally in 1937. This report is currently being extended with annual records of the commercial timber production. The fire depletion study was begun in 1938 and completed for northeastern Washington. The same study is about 60 percent complete for the North Idaho unit. Fire damage and loss data have been collected in the field on the 8,999 MM acres of forest land inventoried in Montana to date. Such figures were collected on the 20 million acres of forest land mapped in western Montana in 1938. An estimate was also made of the average annual epidemic insect loss for the North Idaho unit. Arrangements have been made for obtaining white pine blister rust losses. The Depletion phase of the Forest Survey for the region as a whole can be considered as about 46 percent complete.

In order to complete the data needed for the contemplated publication, "Forest Resources of Northern Idaho", work was resumed on the Requirements phase of the Forest Survey during the latter part of the year. The two principal objectives of this project are (1) the determination of the volume of lumber remanufactured into secondary products,

and (2) the volume of all timber products actually consumed within the Region. This information will bridge the large gap in the data concerning the timber products needs of the Northern Rocky Mountain Region. Moreover, it is information vitally necessary to a rounded approach to the solution of present forest problems.

The consumption of timber products has varied from year to year and period to period depending upon a number of complex factors. However, it is possible to measure this utilization and understand the past variations and possible future trends by considering the different types of consumption separately. For example, the use of wood products in urban construction, in farm construction, by the mining industry, and by the railroads has in each case developed more or less independently of the others. The major accomplishment in 1938 has been the collection of practically all of the basic data needed for these independent studies. Some analysis of these data has been made. It will now be possible to finish the project and release a mimeographed report in the early part of 1939. This phase of the Survey will be completed in 1939.

As already mentioned all estimates of timber consumption are more or less dated. For example, if the average annual production of minerals were markedly higher or lower during the coming few years than during the past period covered by the estimates, the consumption of timber products by the mining industry would be higher or lower also, as the case might be. Likewise, a great expansion or drastic curtailment of highway construction would have a corresponding effect upon the wood used in this connection. However, it is possible to take advantage of this very

close relationship between ore tonnage and wood consumption on the one hand, and dollars expended and wood consumption on the other. For instance, from data covering a 7-year period, it has been noted that sawed products were used in connection with Montana highway construction projects at the rate of 860 board feet per every thousand dollars total cost. The figures for none of these years differed from the average by more than 10 percent. By computing such factors as these wherever possible in connection with the several requirements studies, periodic revisions of the statistics in these cases, to allow for such changes, are at once easy and practical as data on ore production or highway costs are always available.

The value of the Forest Survey of the Northern Rocky Mountain region will, in the end, be measured by the degree of skill with which the vast amount of factual material collected in its Inventory, Growth, Depletion, Requirements, and Economic phases is interpreted and expressed in courses of action. While the Forest Survey is intended primarily to provide the basic data needed by the various agencies engaged in forest planning, the objective looks farther than this, however, and includes the interpretation of this basic data by the Survey organization to insure, as much as this is possible, that the full measure of knowledge is derived from the "jigsaw" of the unadorned facts.

No intensive and complete analysis of any subdivision of the region has yet been made pending the completion of the basic data, although a certain amount of groundwork has been laid in the preliminary findings revealed in the 13 Forest Survey county statistical publications released during 1937 and 1938. A study of the major trends in the Idaho lumber industry included in a recently published article, "A Century of Lumbering

in Northern Idaho", likewise falls into this category. During 1938 summarization of data on growth and inventory was begun for northern Idaho, and other phases of the Survey entered into the final stages with prospects of finishing the information needed early in 1939. From the wealth of material available, a comprehensive presentation and analysis of the situation and unique problems confronting the lumberman and the public in this white pine belt will be prepared during the coming year under the title "Forest Resources of Northern Idaho."

Unquestionably the major forest management aspect on which present knowledge is most meagre is that concerned with the dependency of the population residing in the forested areas. The lack of knowledge is particularly striking in the case of those communities which have been deserted by their lumber industries during the past few years and yet have continued to thrive, more or less. The sustained drive of these towns has probably been, in part, due to the artificial stimulus of Federal emergency money and, in part, due to resources inclined to be minimized by the more casual observer. It is hoped that by an economic study which will begin during the coming year that it will be possible to shed more light on the social and financial structure of these communities and also to evaluate the effect of the changing scene upon the individual family welfare.

During the coming year the efforts of the entire staff will be concentrated first upon finishing the basic statistics needed for northern Idaho and preparing the comprehensive report, "The Forest Resources of Northern Idaho." The maintenance program will be expanded and all available information collected on the various factors of change.

Work on the Inventory and Growth phases will be pressed in western Montana. The amount of mapping that will be possible depends upon the allotments for the fiscal year 1940. In addition to the "Forest Resources of Northern Idaho" report, the contemplated publications include a requirements report; a report presenting the results of the cedar pole increment study; and several county statistical reports for western Montana. Maps and statistics will be released for 7,196,000 acres and 8,999,000 acres, respectively, in western Montana.

WESTERN RANGE SURVEY

Livestock production is one of the major industries upon which much of the development and prosperity of the Northern Rocky Mountain region has been based. The range lands in this region comprise approximately 65 million acres, or 60 percent of the total land area in all forms of Federal, State, county, and private ownership. The range resources, in Montana, particularly, occupy a key position in any general adjustment and conservation program for the West.

A detailed inventory of the location, extent, value, and present condition of the grazing resources is necessary to determine those management and betterment practices which are essential for the proper development, conservation, and use of the range lands for the social and economic welfare of the region. The basic data made available by such a range inventory can also be used as a guide for the restocking of the drought area and as a basis for equalizing taxation of range lands.

Range surveys have now covered approximately 42 million acres, or 65 percent, of all range lands in this region. Around 32 million

acres of these range surveys have been conducted during the past three years mainly under the AAA program or by the Farm Security Administration and Soil Conservation Service. The bulk of these recent surveys have been done on privately owned range land. Range surveys of some 10 million acres of National Forest land have also been made to date. The Cooperative Western Range Survey project was inaugurated in April 1937, looking towards the ultimate assembly of a detailed inventory of the range resources throughout the 17 western states. The project was designed to prepare maps and tabulations of all grazing land covered by range surveys for the use of ranchers and for land-use planning and by administrative agencies. From these maps and tabulations, together with the written descriptions, the location, extent, kinds, density, and composition of the plant cover, the grazing capacity of range areas was to be worked out. The project at this Station was organized to cover the Northern Rocky Mountain region (WRS - Region E).

The Cooperative Western Range Survey project at this Station, which was initiated in April 1937 and discontinued because of lack of funds on June 30, 1938, completed the drafting of grazing survey maps and tabulated the grazing capacity by sections on approximately $7\frac{1}{2}$ million acres of range land situated in 10 eastern Montana counties. The data were analyzed and reports prepared for the 10 counties pointing up the important range problems in each county with recommendations for improving and conserving the range resources. Petroleum County, Montana, was selected for a more complete and comprehensive report. This report includes (1) a colored type map on a scale of one-inch-to-the-mile, presenting graphically the range forage inventory with surface acres and grazing capacities

in animal months shown for each type, and the facilities relating to range management; (2) a range practice map showing major remedial practices recommended; (3) supplemental tabulations furnishing information on grazing capacities and other important features; and (4) a written report presenting a picture of the range conditions in the county, the major problems of range conservation and recommendations for adjustments in use, improvement and development. This report is now being rewritten by the Montana State Agricultural Station with a view to making it more readable and usable for the average rancher or range user.

When the Cooperative Western Range Survey project was discontinued on July 1, 1938, there was an estimated 18½ million acres (15½ million in Montana) of unassembled AAA range survey data which were ready to be compiled, tabulated, and the data placed on maps. During the 1938 field season range surveys by the AAA and other agencies covered an additional 7 million acres in Montana. This coverage is in addition to the 10 million acres of National Forest range surveys which have been made, compiled, and mapped to date. The 25½ million acres of AAA-FSA-SCS range survey data now available could be compiled, tabulated, and placed on maps at an estimated cost of about 1/4 cent per acre or \$64,000. In addition, money at the rate of \$100 per one million acres would be needed to obtain photostat copies of about 11 million acres from the original field maps not now available in the files of this office, and for the 25½ million acres now unassembled.

Judging by the present use of WRS material and the numerous requests from many individuals, organizations, and agencies for this information, it is evident that the uniform maps and tabulations,

most of them have been specified by the Flood Control Act of 1936 and

together with the written reports, are being used extensively by livestock operators, state grazing associations, and land-use planning agencies in the administration of individual operating units, grazing association, and public owned range lands. For this reason, the continuation of the work of the Western Range Survey is bound to be an important factor in securing the proper application of a set of land management practices that will reasonably insure the restoration and future maintenance of the soil and range resources at their most productive level. This Station, therefore, urgently requests that regular funds for the continuation of the Western Range Survey project be obtained at the earliest opportunity.

FLOOD CONTROL SURVEYS

Due to the steep, mountainous character of much of the region and the heavy snowfall at the higher elevations, high spring run-offs are expected annual occurrences. Because of the rather complete and generally undisturbed cover, either forest, brush, or grass, that mantles the watersheds, these high spring run-offs are usually so controlled that damaging floods are not frequent or widespread. There are certain of the minor drainages, however, where damaging floods have occurred with disturbing frequency. The St. Regis River in Montana, a relatively small drainage unit of the Clarks Fork River watershed, has, for example, had repeated winter or early spring floods which have caused considerable damage to private property. Certain drainages of the Spokane River watershed have also had a number of rather costly floods in the past three decades. The flood-menaced areas are well known locally and most of them have been specified by the Flood Control Act of 1936 and

could be made more or less permanent. Such work would pave the way for subsequent amendments for preliminary examinations. The problem areas within this region include the Colville River in Washington, the Spokane River watershed in Washington and Idaho, the Kootenai River in Idaho and Montana, the St. Regis River in western Montana, and the Milk River in eastern Montana.

In the mountainous portions of this region the farms, community railroad train accidents last year on Foster Creek in eastern Montana is centers, and towns are usually located in the river valleys. In many an example. That such high and uncontrolled run-offs have occurred in cases, the valley floor is narrow, the stream channel crooked and its the past are well known. Jones and Clark in 1904 report a narrow escape gradient steep. Habitations, transportation routes, power, light and from such a circumstance. It is almost dry stream channel is overflowing communication lines and other improvements must, of necessity, be located near what is now about 100 ft. above. Here, likewise, authoritative in close proximity to the river channel. Such locations are always data on the cause of such floods, and the remedial measures to control hazardous where the streams have a tendency to flood. Where floods occur or modify them are not generally available. occur in such locations the loss and damage to private property has been During 1904, a preliminary examination to determine the extent largely concentrated on the fast-water portions of the stream above of the flood problem was made on the Spokane River watershed and a report slack-water and therefore directly within the province of the Department prepared. Largest damage resulting from the 1905 flood involved a loss of Agriculture for recommendations looking towards control. No authoritative data are, however, available on the influence of the forest, brush, and other vegetative cover types common to the steep, mountainous areas of the Northern Rocky Mountain region in preventing or modifying destructive floods. Until such data are available, watershed surveys recommending the remedial action necessary to prevent or modify such floods should proceed with caution. Much valuable information of a more or less empirical nature, however, could be obtained by a qualified man in connection with preliminary flood control examinations if the assignment

watersheds.

could be made more or less permanent. Such work would pave the way for the more intensive and detailed investigations that would be set up when regular forest and range influences funds for the Station were made available.

In the Great Plains area of the region cloudbursts have on occasions been the cause of some very destructive floods and washouts. The railroad train accident last year on Custer Creek in eastern Montana is an example. That such high and uncontrolled run-offs have occurred in the past are well known. Lewis and Clark in 1804 report a narrow escape from such a cloudburst filling an almost dry stream channel to overflowing near what is now Great Falls, Montana. Here, likewise, authoritative data on the cause of such floods and the remedial measures to control or modify them are not completely available.

During 1938, a preliminary examination to determine the existence of the flood problem was made on the Spokane River watershed and a report prepared. Direct damage resulting from the 1933 flood amounted to more than a million dollars on that portion of the South Fork of the Coeur d'Alene River above slack-water. Funds for a detailed watershed survey of the problem areas of the Spokane River watershed were recommended. Joint public flood control hearings, in cooperation with U. S. Army Engineers, were held on the Clarks Fork watershed, the Colville River in Washington, and the Kootenai River in Idaho. Several meetings of Committee 23-A were held and some data obtained on the St. Regis, Colville, and Kootenai River drainages. Plans for 1939 contemplate the completion of preliminary examinations and the preparation of reports on the three above mentioned watersheds.

January 1968

REPORT SUMMARY - WESTERN WHITE PINE

FIELD DIVISION: Forest Management Research

WORK PROJECT: Silviculture

LINE PROJECT: Forest Holdings (western white pine type)

PURPOSE OF WORK: To develop methods of cutting that will result in adequate natural regeneration of desired species through investigation of silvicultural factors.

REVIEW OF WORK: Part of the Station's silvicultural program for the past 15 years has centered around the problems of methods of cutting and natural regeneration. Various studies of cutting methods, seed supply, seed production, initial survival, establishment, and early development have been made and reported upon from time to time in numerous technical bulletins and various manuscripts. The results of most of these studies have been brought together in comprehensive fashion in "Natural Regeneration in the Western White Pine Type" now submitted for publication as a technical bulletin. With the completion of this project, most of these studies have been closed and the way cleared for new studies and a critical evaluation of further research needs in this field. **PROJECT STATUS SHEETS** undertaken, greatest emphasis has been placed on seedling development during the early and formative years of the forest stand.

ACCOMPLISHMENTS: 1. A preliminary study of root rot (caused by *Armillaria mellea*) of western white pine stands cooperatively conducted by the Experiment Station, the Coeur d'Alene Forest Insect Laboratory of the Bureau of Entomology and Plant Quarantine, and the School of Forestry, University of Idaho. The study yielded considerable information on the incidence and development of *Armillaria mellea* on white pine in selected study areas, its relation to tree health, and some further knowledge of the nature and habits of the fungus on white pine. 2. A limited amount of work comparing methods of measuring intensity of light beneath forest canopies. Ocular methods were found to be reliable for many field studies. 3. Field work and part of the analysis completed on a study of the economic aspects of silvicultural practice in the western white pine type built around the work of Coeur d'Alene River as a case unit. This study should help in orienting the silvicultural research program by determining the relative values. The study is being used by Davis as a graduate dissertation at University of Michigan.

PLANS FOR FUTURE WORK: Additional field work on seedling development and seedling establishment and preparation of a manuscript during winter of 1968-69 continuing the work and previous work of a similar nature. Completion of a partially prepared manuscript "Natural Regeneration on Western White Pine in the Western White Pine Type." Completion of the economic analysis of silvicultural practice in the white pine type and the preparation of a manuscript for publication.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: C. A. Wallner,
K. F. Davis (economic study only).

HARVEST CUTTINGS - WESTERN WHITE PINE

FIELD DIVISION: Forest Management Research

WORK PROJECT: Silviculture

LINE PROJECT: Harvest Cuttings (western white pine type)

PURPOSE OF WORK: To develop methods of cutting that will result in adequate natural regeneration of desired species through investigation of controlling factors.

REVIEW OF PAST WORK: Much of the Station's silvicultural program for the past 25 years has centered around the problems of methods of cutting and natural regeneration. Various studies of cutting methods, seed supply, seed germination, initial survival, establishment, and early development have been made and reported upon from time to time in numerous publications and Station manuscripts. The results of most of these studies have been brought together in comprehensive fashion in "Natural Regeneration in the Western White Pine Type" now submitted for publication as a USDA technical bulletin. With the completion of this manuscript, several of these studies have been closed and the way cleared for new studies and a critical evaluation of further research needs in this field. Of new work undertaken, greatest emphasis has been placed on studies of seedling development during the early and formative years of development of the forest stand.

ACCOMPLISHMENTS DURING PAST YEAR: 1. A preliminary study of root rots (caused principally by Armillaria mellea) of western white pine stands cooperatively conducted by the Experiment Station, the Coeur d'Alene Forest Insects Laboratory of the Bureau of Entomology and Plant Quarantine, and the School of Forestry, University of Idaho. The study yielded worthwhile information on the incidence and development of Armillaria mellea on white pine in selected study areas, its relation to bark beetle attacks, and some further knowledge of the nature and habits of the fungus on white pine. 2. A limited amount of work comparing methods of measuring intensity of light beneath forest canopies. Ocular methods were found to be reliable for many field studies. 3. Field work and part of the analysis completed on a study of the economic aspects of silvicultural practice in the western white pine type built around North Fork of Coeur d'Alene River as a case unit. This study should help in orienting the silvicultural research program by furnishing some measure of relative values. The study is being used by Davis as a Doctorate dissertation at University of Michigan.

PLANS FOR 1939: Additional field work on seedling development and seedling stand composition and preparation of a manuscript during winter of 1939-40 covering this work and previous work of a similar nature. Completion of a partially prepared manuscript "Natural Reproduction on Cutover Areas in the Western White Pine Type." Completion of the economic analysis of silvicultural practice in the white pine type and the preparation of a manuscript for publication.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: C. A. Wellner,
K. P. Davis (economic study only).

STAND IMPROVEMENT - WESTERN WHITE PINE

FIELD DIVISION: Forest Management Research

WORK PROJECT: Silviculture

LINE PROJECT: Stand Improvement (western white pine type)

PURPOSE OF WORK: To develop cultural measures which will improve the quality and growth of immature stands.

REVIEW OF PAST WORK: Studies of intermediate cuttings were begun in 1914 with the establishment of a series of thinning plots. Work was continued in a more or less desultory fashion until 1933, when, with the establishment of the Deception Creek Experimental Forest and availability of emergency funds, a moderate program of stand improvement was undertaken. Fairly extensive work was also done by the administrative organization. In 1936 available information on stand improvement practices was assembled in a mimeographed manual, "Stand Improvement Practice in the Western White Pine Type", accepted by Administration as standard instructions for this class of work. The present status of the project is as follows: 20 permanent plots in young stands of less than pole size; several large-scale cleaning projects under extensive observation; 39 thinning plots in pole-size stands (one of these is a 16-subplot latin square); and 5 pruning plots.

ACCOMPLISHMENTS DURING PAST YEAR: (1) In cooperation with Region One completed field work on an inventory and summary of all stand improvement work done to date in the forests of the Region. The purpose of this project, financed by the CCC, is to assemble in systematic and usable form information on stand improvement work necessary to give a clear picture of practice to date and, particularly in years to come, a basis for an appraisal of the actual silvicultural improvement effected in the timber stands treated.

(2) Extension work continued with administrative organization to check applicability of present methods and suggest improvements in technique.

(3) Three plots established in pole stands of white pine to determine incidence of decay following pruning.

PLANS FOR 1939: (1) Complete inventory and summary of all stand improvement work done in the region and prepare unit reports for individual projects and a general report summarizing stand improvement practices.

(2) Continue extension work with administrative organization.

(3) Examine thinning plots established in 1914 and 1919, analyze data obtained, and prepare progress report covering results during winter 1939-40.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: K. P. Davis

STAND IMPROVEMENT - PONDEROSA PINE

FIELD DIVISION: Forest Management Research

WORK PROJECT: Silviculture

LINE PROJECT: Stand Improvement (ponderosa pine type)

PURPOSE OF WORK: To develop cultural measures which will improve the quality and growth of immature stands.

REVIEW OF PAST WORK: Twelve plots to test different weights of thinning established on the Lolo National Forest during 1933 in a 50-year-old ponderosa pine stand. Three additional thinning plots established on the Lolo National Forest in a 30-year-old stand during 1935.

ACCOMPLISHMENTS DURING PAST YEAR: Establishment of a plot to investigate pruning of ponderosa pine.

PLANS FOR 1939: Preparation of a 5-year progress report summarizing results from 1933 series of thinning plots.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: K. P. Davis

PHENOLOGY

FIELD DIVISION: Forest Management Research

WORK PROJECT: Silviculture

LINE PROJECT: Silvics (Phenology)

PURPOSE OF WORK: To determine seasonal vegetative events of principal trees and shrubs in Region One.

REVIEW OF PAST WORK: Project started in 1928 with phenological observations being made on 18 National Forests, at Savenac Nursery, Priest River Experimental Forest, Yellowstone, and Glacier National Parks. Observations made by ranger. Observations dropped on 12 Forests between 1932 and 1934. At the beginning of 1937 observations were being made at only 9 stations. Project terminated in 1937 because the Station found it impossible to give adequate technical supervision. Although a large mass of information has been collected, its usefulness is greatly limited by lack of uniformity and thoroughness in making observations.

ACCOMPLISHMENTS DURING PAST YEAR: None.

PLANS FOR 1939: A thorough compilation of the phenology data; preparation of a report, during winter of 1939-40, summarizing useful information.

DATE OF COMPLETION: Project terminated except for preparation of final report.

ASSIGNMENT: C. A. Wellner.

January 1939

STAND STUDIES - WESTERN WHITE PINE

FIELD DIVISION: Forest Management Research

WORK PROJECT: Mensuration

LINE PROJECT: Stand Studies (western white pine type)

PURPOSE OF WORK: To determine composition, growth, yield, and mortality of stands of the western white pine type.

REVIEW OF PAST WORK: 1. Type-wide study of growth and yield in fully stocked natural stands. (Published as U.S.D.A. technical bulletin 323.)
2. Establishment and periodic remeasurement of 34 permanent and 54 semipermanent yield plots in natural stands.
3. Increment and mortality observations of the residual stand on 24 permanent plots in cutover, mature, and overmature stands. Ten-year records available for 9 of these plots showed a consistent loss of the residual stand in net volume amounting to 20 percent the first decade, substantiating the observation that old white pine stands have a tendency to deteriorate following a partial cutting.
4. Type-wide study, begun in 1928 and field work completed in 1937, of increment in cutover stands using temporary plot technique.

ACCOMPLISHMENTS DURING PAST YEAR: A need for further information on the causes and extent of mortality to strengthen and supplement increment data previously gathered was met by a type-wide study of mortality in cutover white pine stands made during a period of two months by a crew of three to four men. Data, compiled and analyzed, showed that on Forest Service sales growth approximately balanced mortality during the first decade while during the second decade, with decreased mortality and slightly increased increment rate, substantial net growth was made.

PLANS FOR 1939: Preparation of a comprehensive publication bringing together the results of the 1928, 1937, and 1938 studies, together with information from permanent sample plots in cutover stands, is scheduled for the winter of 1939-40. No new field work is planned during the year.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: K. P. Davis

STAND STUDIES - PONDEROSA PINE

FIELD DIVISION: Forest Management Research

WORK PROJECT: Mensuration

LINE PROJECT: Stand Studies (ponderosa pine type)

PURPOSE OF WORK: To determine composition, growth, yield, and mortality of stands of the ponderosa pine type.

REVIEW OF PAST WORK: A total of 186 temporary yield plots established in even-aged stand during the period 1932-34 as part of an interregional growth study. Data turned over to the Pacific Northwest Station which prepared technical bulletin no. 630, "Yield of Even-Aged Stands of Ponderosa Pine" in 1938. About 110 of temporary plots selected for remeasurement as semipermanent yield plots. Six permanent yield plots in Lolo National Forest measured periodically.

ACCOMPLISHMENTS DURING PAST YEAR: None.

PLANS FOR 1939: None.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: K. P. Davis

STAND STUDIES - LARCH-DOUGLAS FIR

FIELD DIVISION: Forest Management Research

WORK PROJECT: Mensuration

LINE PROJECT: Stand Studies (western larch-Douglas fir type)

PURPOSE OF WORK: To determine composition, growth, yield, and mortality of stands of the western larch-Douglas fir type.

REVIEW OF PAST WORK: 1. Measurement of increment and mortality 25-35 years after cutting on 86 temporary plots in selectively cut stands. Most of office compilations made and preliminary report prepared. Final report for publication yet to be prepared.

2. Five permanent yield plots established during last 25 years in fully stocked natural stands.

3. Yield study of even-aged stands made by Forest Survey taking data on 150 temporary plots. Of these 42 have been selected for remeasurement as semipermanent yield plots.

ACCOMPLISHMENTS DURING PAST YEAR: None.

PLANS FOR 1939: Prepare report for publication on study of growth of selectively cut stands described under 1 above.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: C. A. Wellner

FIELD DIVISION: Forest Management Research

WORK PROJECT: Regeneration

LINE PROJECT: Planting

PURPOSE OF WORK: To develop methods of artificial regeneration which are economically and silviculturally satisfactory.

REVIEW OF PAST WORK: Investigative work in planting and nursery practice started with the establishment of the Priest River Station in 1911 and continued intermittently until 1926. Nursery studies in such fields as germination, seedbed densities, season of sowing, root pruning, etc., have been reported on in numerous publications and station manuscripts. Studies in direct seeding, conducted between 1910 and 1921 and reported on by Wahlenberg, did not develop any successful methods. Planting studies, also reported on in numerous publications, developed successful planting technique and indicated that season of planting had no appreciable effect on survival, that transplant stock was better than seedling stock. Investigative work was resumed in 1936 with the start of a 5-year cooperative planting study between Station and Regional Office of Planting. This study, which attacked the problems of grade, age, and class of stock, carefulness of handling and planting stock, season of planting, and soil factors, has been continued by Region with Station furnishing advice and some help. The Station has concentrated its efforts the past 2 years on direct seeding; 4 latin square plots to test direct seeding were established in fall of 1937. An arboretum for demonstration was started at Priest River Station in 1931. By end of 1937 it covered an area of approximately 100 acres and included 45 species in blocks of sufficient size to simulate stand conditions for each species.

ACCOMPLISHMENTS DURING PAST YEAR: 1. Direct seeding studies were continued. Four new latin square plots to test spring sowing were established, making a total of 8 direct seeding plots. These have shown that fall sowings of ponderosa pine, western white pine, and Engelmann spruce are successful in screened spots; Engelmann spruce sowings, both spring and fall, are successful without screens. Small tests of several commercial rodent repellents proved them to be unsatisfactory. 2. Continued cooperation with Region in planting studies. An outstanding find of these studies is that extra care in handling and planting stock over that used by crews resulted in 20% higher survival. 3. All available plantation records were analyzed by Station and report prepared for publication. This analysis shows better survival in spring-planted stock, no survival difference in age classes of stock, only 42% average survival 10 years after planting. 4. Arboretum plantings continued at Priest River Station. Blocks of 16 species were brought up nearly to capacity.

PLANS FOR 1939: 1. Continue direct seeding investigations; test use of poisons to protect seed spots of white & ponderosa pines; test western red cedar for use in direct seeding; compare rapid germination tests with standard tests; study ripeness of cones. Prepare comprehensive plan for direct seeding research. 2. Continue cooperation with Planting on 5-year study. 3. Continue arboretum plantings at P.R. Station. Plant fall places on old blocks; plant 7 blocks to new species, and complete maps of area.

DATE OF COMPLETION: Continuing project (station studies contingent CCC Funds)
ASSIGNMENT: K. P. Davis and C. S. Schopmeyer,

GEOGRAPHIC RACES

FIELD DIVISION: Forest Management Research

WORK PROJECT: Forest Genetics

LINE PROJECT: Segregation (geographic races of ponderosa pine)

PURPOSE OF WORK: To determine suitability of ponderosa pine seed from different sources for planting in northern Idaho; to ascertain heritable characteristics of growth, form, and hardiness developed through adjustment of parents to local climates.

REVIEW OF PAST WORK: Trees grown from seed of ponderosa pine collected in 21 widely separated localities in the western United States were planted in plots at the Priest River Experimental Forest in the years 1911-17. Plots studied and reported upon by Kempff in 1927. Thorough field examination and measurements made in fall of 1935 and analysis made by Weidman. Differences with respect to number of needles to the fascicle, length of needles, general appearance of foliage, and thickening of hypoderm found among progeny groups derived from different regions within range of ponderosa pine in the United States, which were delimited on the basis of precipitation type. Characteristics as to persistence of needles found not to be hereditary. Pronounced differences found among different progenies in height growth, diameter growth, relation of two, and relative height growth by years. Best growth in height and diameter made by trees derived from localities resembling locality of planting site in climate. As sources of seed for planting in northern Idaho, experiment indicates trees of North Pacific region unsuitable because of low frost resistance, those of Black Hills and southeastern Montana questionably suitable because of early decline in growth rate, those of Central and South Plateaus and Colorado decidedly unsuitable because of distinctly poor rate of growth. Findings to date indicate most suitable general territory in which to collect ponderosa pine seed for northern Idaho use extends from Colville locality, in Washington, eastward a little beyond Continental Divide and from Salmon River to Canadian boundary. Manuscript "Racial Influences in a 25-Year Test of Ponderosa Pine" submitted in September 1937 for publication in Journal of Agricultural Research.

ACCOMPLISHMENTS DURING PAST YEAR: None.

PLANS FOR 1939: Publication of report described above.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: C. A. Wellner

RS-NRM
Pf-1
Attack

January 1939

PRESUPPRESSION, DETECTION, SUPPRESSION

FIELD DIVISION: Forest Management

WORK PROJECT: Fire Protection

LINE PROJECT: Pf-1, Fire Control Planning

PURPOSE OF WORK: To determine the principles, methods, and procedures that will furnish adequate manpower and facilities for fire control at least cost in accordance with local values at stake, occurrence of fires, and fuel types.

REVIEW OF PAST WORK: Started in 1931 and prosecuted actively through 1935, with great assistance from the Regional Office in funds and personnel. Planning methods evolved and applied by Region on 17 National Forests comprising 23 million acres, and on National Park, and private forest lands. Progress report, "Fire Control Planning in the Northern Rocky Mountain Region" multilithed in 1936. Success of these methods in Region One resulted in nationwide application with local modifications.

ACCOMPLISHMENTS DURING PAST YEAR: Article "Hornby's Principles of Fire Control Planning" submitted for publication.

PLANS FOR 1939: Intensive checking of rates of spread and rates of held-line construction urgently needed to improve bases of fuel type classification. Some 10,000 fire reports have been punch carded and should be analyzed to determine (a) effects of improved facilities, manpower, and methods resulting from past planning, and (b) additional improvements and changes possible and needed to increase efficiency and decrease costs. A "Fuel Reduction Manual" should be prepared to guide such work being done extensively in Region One.

DATE OF COMPLETION: Five years' work needed with increased funds.

ASSIGNMENT: H. T. Gisborne, for general supervision.

BEHAVIOR OF FIRES

FIELD DIVISION: Forest Management

WORK PROJECT: Fire Protection

LINE PROJECT: Pf-2, Behavior. Daily and seasonal variables.

PURPOSE OF WORK: To determine the relation between meteorological elements and inflammability of the fuels of forest fires, including the factors of inflammability and how each may best be measured. Involves (1) what to measure; (2) how to measure; (3) where to measure; (4) when to measure; and (5) how to integrate these measurements into a practical scale of inflammability and fire danger.

REVIEW OF PAST WORK: Started in 1922. Factors to be measured, preliminary methods of measurements, and integrating "danger meter" first deemed satisfactory in 1931. Methods tested on 10 National Forests 1931 to 1933. Made official standard practice on 10 Forests in 1934. Extended to all 17 National Forests in Region One in 1936. Miscellaneous publication no. 29 published in October 1929. U.S.D.A. circular no. 398 published in July 1936. Two special phases, "Altitude and Aspect" and "Vegetation" studies segregated for more intensive work since 1934 and 1935, respectively. Duff hygrometer, wood cylinder, anemo-hygrograph, and fire danger meter originated by this research. Commercial manufacturer encouraged and aided in evolving low-cost anemometer which permitted Region One to equip all wind stations at a saving of more than \$17,000. More refined danger meter issued in 1938, bearing on purpose 5, above. Research materially curtailed in 1937 by reduction of qualified personnel.

ACCOMPLISHMENTS DURING PAST YEAR: Report on "The Effect of Certain Chemical Attributes of Vegetation on Forest Inflammability" submitted for publication. With the completion of records for a fourth season, 1938, a report is being prepared on "Variations of certain fire danger factors with altitude and aspect." Both of these reports bear directly on purposes 1, 2, and 3, above.

PLANS FOR 1939: Make statistical analysis of fire danger ratings 1934-38, inclusive, on 10 Forests to determine seasonal curves of normal, worst probable, and least probable fire danger, basic to fire control finance and planning. Start work on a "Fire Behavior Meter" and "Fire Dispatchers Guide." Determine whether present meter should be further modified for most dependable use in eastern Montana.

DATE OF COMPLETION: Unknown.

ASSIGNMENT: H. T. Gisborne,
G. L. Hayes on Altitude and Aspect phase.

January 1939

RANGE UTILIZATION STANDARDS

FIELD DIVISION: Range Research - in cooperation with Region One

WORK PROJECT: Grazing Management

LINE PROJECT: Range Utilization Standards

PURPOSE OF WORK: To develop practicable standards for judging when ranges are properly utilized.

REVIEW OF PAST WORK: No research funds allotted this year and A&P funds available last year for Regional Office cooperation not continued.

ACCOMPLISHMENTS PAST YEAR: Data collected in 1937 at Miles City and Vigilante analyzed and reports written by Holscher and Brierley. Certain phases of this work now being carried under Ecological Methods projects at Miles City, as already described. A utilization survey made of portion of Vigilante cattle range to test use of volume table constructed by Region. Results not yet fully compiled.

PLANS FOR 1939: Continue to extent possible under Ecological Methods project at Miles City with tests to the extent possible at Vigilante.

DATE OF COMPLETION: Discontinue as project until funds are available.

ASSIGNMENT: Incidental to Methods work by R. W. Collins.

MANAGEMENT SUMMER RANGES

FIELD DIVISION: Range Research

WORK PROJECT: Grazing Management

LINE PROJECT: Management Summer Ranges

PURPOSE OF WORK: To determine best management and utilization practices for summer cattle and sheep ranges; vegetation and economical production both considered.

REVIEW OF PAST WORK: Not yet financed on project basis. Work confined largely to fence and improvement building mainly from ERA and other emergency funds, supervision from regular funds. Weight of clippings from fenced plots in 1937 compared to grazed plots failed as set up to provide satisfactory and reliable guide to degree of utilization when analyzed. Diameter of clumps and other data from this study may provide basis for showing effects of protection after few more years.

ACCOMPLISHMENTS PAST YEAR: Water system at Vigilante, buildings, and some special plots practically completed and some station fencing and range water developments done.

Initiated in 1938 plant development study at three elevations on cattle ranges to correlate with weather and proper season of use.

Initiated in 1938 systematic measurements of height to determine utilization with aid of available volume table. Data not yet completely analyzed. Continued test of cheatgrass range for horses in cooperation with Regional Office. For two seasons of about 6 and 5 months, respectively, horses have been carried in satisfactory condition at average rate of 1.6 acres per horse month which compares favorably with good bunchgrass range. Management to encourage cheatgrass not advocated but it has substantial value pending establishment of more dependable grasses.

PLANS FOR 1939: Confine efforts at Vigilante to improvement work and simple plot records until funds are available for more comprehensive project on season of use and other management projects with adequate design and personnel.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: L. C. Hurtt and Junior Range Examiner T. E. Brierley.

MANAGEMENT SHORT-GRASS RANGES

FIELD DIVISION: Range Research

WORK PROJECT: Grazing Management

LINE PROJECT: Management Short-grass Ranges

PURPOSE OF WORK: To determine best range management and utilization practices for both cattle and sheep; vegetation and economics of production both considered.

REVIEW OF PAST WORK: Started in 1932 on cattle and in 1936 on sheep ranges at Miles City. Yearly quadrat chartings on cattle range show vegetation density reached low point of drought at approximately 10 percent of 1933, early in 1937, but by June 1938 had increased to approximately 24 percent of the 1933 level. Cactus has increased alarmingly. Density trends for five years vary so slightly between three intensities that it must be concluded that drought effects have completely overshadowed effects of intensity to date. However, a heavy penalty in form of reduced calf crop and weight and increased feed costs resulted from overgrazing through drought period. During five of six years, 1933-1938, inclusive, (dry heifers used in 1937) 20 cows overgrazed ranges produced 73, 84, and 80 weaning calves aggregating 19,741, 25,712, and 24,862 pounds, respectively. Total feed costs (range plus supplemental feed, cumulative for five seasons) were approximately 5.4, 3.7, and 4.0 cents per pound of weaning calf weights which emphasize economic penalties of overstocking even where drought is a major handicap.

Sheep on overgrazed pastures made significantly less gains than on larger pastures for first time in 1938. Need still heavier stocking and better distribution to get consistent results. Number of plots increased but results not yet significant, based on data partially compiled to date.

ACCOMPLISHMENTS PAST YEAR: Increasing trend in density due mainly to enlargement of surviving vegetation. Few seedlings survived except Stipa and Sandberg bluegrass. Latter now dominant. Increase in volume production far greater than increase in density due mainly to unusual 1938 height growth. Animal months' feed in 1938 approximately 75 percent of 1933 level. Calf crop 75, 80, and 90 percent, respectively, on overgrazed, moderately, and lightly grazed. Progress made in getting better distribution of sheep by charged fences but still not satisfactory.

PLANS FOR 1939: Continue to study response of vegetation, cattle, and sheep to weather and intensity of use as basis for better management. Improve methods for measuring response of vegetation and for distributing sheep.

DATE OF COMPLETION: Not before 1947.

ASSIGNMENT: L. C. Hurtt, E. J. Woolfolk, R. W. Collins in cooperation with B.A.I. and Mont. Agric. Expt. Sta. at U.S.R.L. Expt. Station.

COOPERATIVE WESTERN RANGE SURVEY - REGION E

FIELD DIVISION: Range Research

WORK PROJECT: Grazing Management

LINE PROJECT: 10. Western Range Survey - Region E.

PURPOSE OF WORK: The Cooperative Western Range Survey project was inaugurated in April 1937 looking towards the ultimate assembly of a detailed inventory of the range resources throughout the 17 western states. Region E includes all of Montana, ten counties in northern Idaho, and four counties in northeastern Washington. The project is designed to prepare maps and tabulations of all grazing land covered by range surveys for the use of ranchmen and for land-use planning and administrative agencies. From these maps and tabulations, together with the written descriptions, the location, extent, kinds, density, and composition of the plant cover, the grazing capacity of range areas may be determined. With this information available the management practices essential for the maintenance, improvement, and proper use of the range may be worked out.

REVIEW OF PAST WORK: This project was started in April 1937. Inter-agency committees organized, meetings held, and forms, methods, and technique of doing job developed. Made 1/2-inch and 1-inch-to-mile base maps for six counties. Compiled preliminary range data on approximately two million acres in four counties. Made grazing maps for one-half million acres.

ACCOMPLISHMENTS DURING PAST YEAR: Completed the drafting of grazing survey maps, and tabulated the grazing capacity by sections on approximately $7\frac{1}{2}$ million acres of range land situated in 10 eastern Montana counties. Analyzed the data and prepared reports on the 10 counties. Prepared a more complete and detailed report on Petroleum County. The project was discontinued officially on June 30, 1938, due to lack of funds. Four man-months' time, contributed by Region One and Station personnel since July 1, 1938. Work accomplished includes answering some 25 letters requesting information or maps and reviewing of revised Petroleum County reports.

PLANS FOR 1939: Continue to fill requests for information and maps already compiled. If possible, obtain State WPA project to continue assembling, tabulating, and mapping the $15\frac{1}{2}$ million acres of AAA-RCP range surveys in Montana now available.

DATE OF COMPLETION: Indefinite. No funds for project now available.

ASSIGNMENT: A. Cramer to June 30, 1938,
D. Duncan, L. C. Hurtt, M. Bradner.

January 1939

RESEARCH METHODS IN RANGE PLANT ECOLOGY

FIELD DIVISION: Range Research

WORK PROJECT: Grazing Management

LINE PROJECT: Research Methods, Range Plant Ecology

PURPOSE OF WORK: Evaluate existing and devise better methods and procedures for measuring response of range vegetation to habitat factors and various treatments.

REVIEW OF PAST WORK: Of the several methods tested for measuring vegetal density, the decimeter-frame-estimate method is being used in a series of paired major plots, selected as comparable after frequency surveys. Used as one method for comparing adjacent pastures on both cattle and sheep ranges. Charted quadrats being continued and special efforts made to analyze and interpret data.

ACCOMPLISHMENTS PAST YEAR: Holscher's report of March 1938 summarizes results of clipping Agropyron smithii and construction of curves for measuring utilization. Additional paired plots as above established on sheep range in 1938. Two methods to measure utilization tried in 1938 on cattle ranges, one by clipping paired plots, half of which are protected by temporary cages and half open to grazing, the other by measuring height and use of volume by height tables. New device for measuring extent of vegetation cover was given preliminary trial and offers some encouragement for further development.

PLANS FOR 1939: Compile and analyze data collected in 1938 on above subprojects. Using results as a basis, continue search for more rapid and adequate methods of measuring response of utilization by following leads already uncovered and testing new ones. A satisfactory method for comparisons of pastures under different treatments especially needed.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Newly appointed Junior Range Examiner R. W. Collins, with assistance of E. J. Woolfolk, assigned until more experienced man can be found for leader.

BEST SPECIES AND MIXTURES FOR ARTIFICIAL RANGE REVEGETATION

FIELD DIVISION: Range Research

WORK PROJECT: Artificial Range Revegetation

LINE PROJECT: Best Species and Mixtures for Artificial Revegetation

PURPOSE OF WORK: To test species and mixtures and relative grazing values of each for revegetating depleted ranges.

REVIEW OF PAST WORK: Approximately 1,735 acres seeded largely on demonstration field basis prior to 1938, includes about 1,250 acres on rancher cooperator lands and 485 acres on national forests and experimental areas. Crested wheatgrass used on major part of total area and has been by far most successful of more than 20 species tried during drought period. Tentative conclusions from field tests as to depth, rate, and time of seeding being tested by replicated controlled plots since 1936. Sweet clover and smooth brome next most promising species on lower ranges but tall oat and mountain brome grass also promising for mountain areas. A field of about 40 acres now available at U. S. Range Livestock Experiment Station for testing value of crested wheatgrass compared to native range.

ACCOMPLISHMENTS PAST YEAR: Reexamination in 1938 of a portion of previously reseeded cooperative ranch areas indicates about 41 percent success for fall seeded and 33 percent success for spring seeded areas and that of the total area an additional 15 percent promises to become successful from continued increase from established but scattered stands of crested wheatgrass. The 3-5 pound rate appears ample.

Yield clippings made on reseeded and unseeded portions of eight fields show palatable forage nearly threefold (285 percent) greater on reseeded portions, mainly through replacing weeds and downy brome. Ranchers enthusiastically increasing crested wheatgrass acreage.

Adaptation nurseries established in 1938 at Missoula, Miles City, and Vigilante and plots fall seeded to 77, 44, and 65 species, respectively. Replicated field plots established in 1938 for field tests at Miles City for crested wheatgrass and brome grass on unplowed but depleted ranges.

PLANS FOR 1939: Stress development of three adaptation nurseries and establish 2 or 3 representative new ones; develop detailed working plan for adaptation and life history phases of species and mixtures. Compare grazing value of crested wheatgrass and native range.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: L. C. Hurtt, L. R. Short, and W. L. Norem.

SITE FACTORS IN ARTIFICIAL RANGE REVEGETATION

FIELD DIVISION: Range Research

WORK PROJECT: Artificial Range Revegetation

LINE PROJECT: Site Factors in Artificial Revegetation

PURPOSE OF WORK: Determine the soil characteristics and other site factors, altitude, climate favorable for artificial revegetation.

REVIEW OF PAST WORK: Reseeding of several hundred acres done mainly at low elevations from about 2300 up to 6800 feet and to 8600 feet in one case. Rough soil tests made with field testing kit where mineral deficiencies are suspected have proven inconclusive. The influence of shade on surface soil temperatures and of native forage competition has been mentioned under methods or species division of this project but comprehensive study of site factors not yet initiated. Crested wheatgrass has succeeded on alkaline soil and on a wide range of soil texture. A survey has been made of numerous national forest areas. Site conditions favorable for revegetation roughly indicated for each.

ACCOMPLISHMENTS PAST YEAR: At 8600 feet crested wheatgrass, mountain brome, and tall oatgrass have survived two seasons in contour furrows but have shown better development at 6800 feet and lower. Data not available on elevations 6800 to 8600 feet. Influence of fertilizers tested on small plots not yet conclusive.

PLANS FOR 1939: Only incidental planned work on this phase of range revegetation except what ties closely with species and methods. Continue surface soil temperature study, locate, and evaluate additional national forest areas in need of artificial revegetation.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: L. C. Hurtt and W. L. Norem.

PRACTICABLE METHODS FOR ARTIFICIAL RANGE REVEGETATION

FIELD DIVISION: Range Research

WORK PROJECT: Artificial Range Revegetation

LINE PROJECT: Practicable Methods for Artificial Revegetation

PURPOSE OF WORK: Develop inexpensive and practicable methods for artificial revegetation of depleted range lands of low value, time and rate of seeding or propagation, depth of cover, equipment, etc.

REVIEW OF PAST WORK: Propagation of buffalo grass by sod "plugs" did not yield promise, cost considered, during severe drought year. Inexpensive seeding methods have been stressed on approximately 1,735 acres reseeded to date. Results seldom justify expense of prior seedbed preparation on abandoned land plowed during drought years. Several unplowed but depleted range areas successfully reseeded, mainly to crested wheatgrass, on the Helena, Deerlodge, and Custer National Forests, and on certain cooperative areas by merely disking after seeding. Seeding in contour furrows promising on steep slopes. Fall seeding has proven superior to spring seeding on field tests; also in limited replicated plot trials.

ACCOMPLISHMENTS PAST YEAR: Initial results from 114 randomized plots on abandoned range seeded at 1/2, 1, and 1-1/2 inches at three fall and three spring dates indicate fall seeding is preferable to spring, October was better than November seeding, and early April better than May dates. More seedlings survived from 1-1/2 inch depth than 1 or 1/2 inch, but the differences were not significant and not in close agreement with previous tests. Further tests required.

Data on effects of shading by thistles in 1938 appear to confirm beneficial effects previously noted but analysis not completed. A study near Three Forks yielded tentative guide as to what density of native perennial cover precludes successful reseeding to crested wheatgrass. Replicated blocks were established at Camels Back area on unplowed but depleted range land for testing field methods on 1/10-acre plots drilled in the spring and fall of 1938. Results from yield plots clipped and quadrats charted not yet compiled. Preliminary trials with special large heavy cut-out disks indicate a place for such equipment for reseeding on brush-covered, rocky slopes.

PLANS FOR 1939: Continue study of field methods for crested wheatgrass and smooth brome grass on both reverting plowed and unplowed drought-depleted ranges. Make further tests of special cut-out disk and continue detailed plot work to refine conclusions as to best depth, rate, date, and minimum seedbed preparation. Revise tentative guide to methods for reseeding crested wheatgrass for use of Forest Supervisors and CCC camps.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: L. C. Hurtt, L. R. Short, and W. L. Norem.

LOGGING AND MILLING INVESTIGATIONS OF
CONVERSION COSTS AND VALUES

FIELD DIVISION: Forest Products

WORK PROJECT: Timber Harvesting and Conversion Investigations

LINE PROJECT: Logging and Milling. Cost values related to methods of cutting.

PURPOSE OF WORK: To provide and disseminate by publication to lumbermen, foresters, and other interested agencies, information on two important phases of logging and milling in the commercially important timber types of the Inland Empire. 1. Forest utilization data that will show for a community an individual operation, logging chance, sample plot, or individual trees, cutting limits (by tree d.b.h. and area), utilization standards, and operating methods necessary for the permanent welfare of the forest community concerned. 2. Logging studies showing efficiency of new logging equipment, new logging methods, and various methods of log transportation and their effect upon good forestry practice.

REVIEW OF PAST WORK: Three of the most important timber types of the Inland Empire have been studied. Publications are now available showing economic cutting limits and other data necessary to selective cutting in the (1) western white pine type, (2) ponderosa pine type, and (3) larch-Douglas fir type. Log and tree grades for ponderosa and western white pine have been developed to facilitate application of the economic principles developed by studies.

ACCOMPLISHMENTS DURING PAST YEAR: A 60-page publication, "Results and Application of a Logging and Milling Study in the Western White Pine Type of Northern Idaho", was printed cooperatively by the University of Idaho, the Idaho State Forester, and the Western Pine Association. This bulletin presented basic production costs and lumber values necessary to the management of western white pine and confirmed the minimum profitable size limit of 14 inches in diameter at breast high established by previous studies.

Tests of the modified Wolfe and Dolmar power saws for logging purposes established the weakness of clutch and motor of the Wolfe saw precluding its use until improved. The Dolmar proved to have a rugged motor and clutch but the saw blade and overall weight of the saw proved a serious handicap.

The Bear Paw project, a study of the possibilities of selectively cutting 65-year-old western white pine when converted to commercial lumber and match plank, was carried to the match splint stage. Yield of match plank was about half as much as from older 140- to 160-year-old timber.

Mapped, cruised, and prepared timber density map and logging plan for a 600-acre white pine tract (Haynes Creek project) on the Deception Creek Experimental Forest where various principles developed by past studies will be demonstrated.

A study of knot development in western white pine indicated that black-knotted lumber (knots formed from dead limbs) is formed for a surprisingly long time. From the time branches die and are grown over so clear wood is being produced, a period of 72 to 93 years elapsed in the trees studied.

- PLANS FOR 1939:
1. Complete Bear Paw study.
 2. Continue Haynes Creek project.
 3. Continue power saw investigations.
 4. Prepare selective cutting and logging plan for ponderosa pine area on Trapper Creek Experimental Forest for demonstration purposes.
 5. Determine relative economy and effect on cutting diameter limits of utilization of square mining timbers versus round by the Anaconda Copper Mining Company.
 6. Study knot development and its influence on lumber quality, if time is available.

DATE OF COMPLETION: Continuous.

ASSIGNMENT:

I. V. Anderson,
E. F. Rapraeger.

UTILIZATION PRACTICES IN THE SAWMILL AND IN THE WOODS

FIELD DIVISION: Forest Products

WORK PROJECT: Timber Harvesting and Conversion Practices

LINE PROJECT: Utilization practices in the sawmill and in the woods.

PURPOSE OF WORK: To obtain, and disseminate by publication, information on (1) overrun data and efficiency comparisons of logging and milling equipment; (2) volume and value losses caused by various manufacturing methods, fire, insects, etc.

REVIEW OF PAST WORK: Studies conducted over the past 15 years have made available basic information on (1) average overrun of lumber over log scale for all commercial species; (2) quantitative and qualitative waste in the milling of lumber; (3) residual wood left after logging in the important timber types; and (4) volume and value losses in fire damaged timber, river driven logs, and logs transported over gravity chutes.

ACCOMPLISHMENTS DURING PAST YEAR: Inactive during 1938 except that numerous inquiries for information on this phase of work were answered.

PLANS FOR 1939: No work planned but carried on active list to provide means of doing small studies requested from time to time by our administrative divisions and the lumber industry.

DATE OF COMPLETION: Continuous project.

ASSIGNMENT: I. V. Anderson,
E. F. Rapraeger.

PROPERTIES AND USES OF SECONDARY SPECIES

FIELD DIVISION: Forest Products

WORK PROJECT: Timber Harvesting and Conversion Investigations

LINE PROJECT: Properties and uses of western larch, white fir, lodgepole pine, western red cedar, and other little used or secondary species of the Northern Rocky Mountain Region.

PURPOSE OF WORK: To furnish owners and users of the secondary timber species of the Northern Rocky Mountain Region with information in published form on the available supply, quality, and suitability for specific uses of these woods.

REVIEW OF PAST WORK: Departmental bulletins 285 and 408 have been published on western larch and white fir. Considerable data were assembled prior to 1933 for a bulletin on lodgepole pine when this work was suspended for more urgent work in connection with the depletion and requirements phase of the Forest Survey. About half of the work necessary for publication of a bulletin on lodgepole pine has been done.

ACCOMPLISHMENTS DURING PAST YEAR: No work done.

PLANS FOR 1939: Demands for factual data on the suitability of Inland Empire western red cedar for shingles and railroad ties, as well as stimulation of the use of lodgepole pine in the Rocky Mountain Region for telephone and power poles and lumber, has revived the need for information on these species. Time permitting, a study of the significance of the variations in the color of cedar heartwood and its influence on commercial use will be studied in 1939.

DATE OF COMPLETION: Continuous project.

ASSIGNMENT: I. V. Anderson, E. F. Rapraeger, and C. N. Whitney in cooperation with Madison Laboratory.

January 1939

DURABILITY OF WOOD - TREATED AND UNTREATED

FIELD DIVISION: Forest Products

WORK PROJECT: Wood Preservation Investigations

LINE PROJECT: Service Test Records

PURPOSE OF WORK: (1) To determine the durability of treated and untreated telephone poles, fence posts, ties, and miscellaneous timbers produced from timber trees native to Montana, Idaho, and eastern Washington. (2) To ascertain the comparative value of various wood preservatives and treating processes. (3) To disseminate results of said work.

REVIEW OF PAST WORK: Periodic examinations of wood used in various forms have been made since 1910 on about 40 installations. At present the project has 20 installations including telephone and power poles, fence posts, mine timbers, and ties scattered widely throughout Montana.

ACCOMPLISHMENTS OF PAST YEAR: Results of patient years of observation of service tests are fast becoming available. Cooperation with the Northern Pacific Railway has resulted in definite knowledge of the service life of local crosstie species. In 1907, when this Company's first treating plant began operating, their replacements averaged 346 ties per mile of track annually; in 1937 only 129 ties were used to do practically the same job. Thirty years ago, their average service life for ties was 9 years; today, it is about 23 years.

PLANS FOR 1939: Make examinations of following wood service tests: 4 telephone lines, 3 railroad tie test tracks, 5 fence and corral posts, and 1 mining timber installation. Prepare memoranda on these inspections and bring reports of previous inspections on all projects up to date. In addition, a manuscript for publication started in 1938 presenting (1) present status of service tests in Region One and (2) results to date of tests on ties, fence posts and poles, and telephone poles will be completed.

DATE OF COMPLETION: Irregular intervals whenever no longer useful.

ASSIGNMENT: C. N. Whitney.

PRODUCTION STATISTICS - LUMBER AND OTHER TIMBER PRODUCTS

FIELD DIVISION: Forest Products

WORK PROJECT: Forest Products Statistics

LINE PROJECT: Statistics on the production of lumber and other timber products.

PURPOSE OF WORK: To obtain accurate data on the production of lumber and other timber products in the States of Montana, Idaho, and northeastern Washington in cooperation with the U. S. Bureau of the Census.

REVIEW OF PAST WORK: As a result of work done by this Station in the past, lumber production data from 1906 to the present time have been made available to the lumber industry and various government agencies that administer publicly owned forest land.

ACCOMPLISHMENTS DURING PAST YEAR: Comparative production figures disclosed an all-time production record of 554 million feet of western white pine lumber. This figure, along with accurate production records for the past 35 years, facilitate predictions of future cut and the duration of existing virgin timber stands. Records also showed that a small cedar shingle industry, producing about 3,700 squares of shingles, had become established in the Inland Empire.

PLANS FOR 1939: Continuation of project.

DATE OF COMPLETION: Continuous project.

ASSIGNMENT: C. N. Whitney,
M. E. Bouchard.

COST STATISTICS - FOR MANUFACTURE OF LOGS AND LUMBER

FIELD DIVISION: Forest Products

WORK PROJECT: Forest Products Statistics

LINE PROJECT: Statistics on the cost of producing logs and lumber

PURPOSE OF WORK: To obtain accurate and detailed logging and manufacturing costs from the larger lumber companies in northern Idaho, eastern Washington, and western Montana by personal contact. Information is used in connection with lumber selling values for the appraisal for sale of Forest Service timber.

REVIEW OF PAST WORK: Detailed average lumber production costs are now available back to 1916. In 1937 costs were obtained from 30 operators representing sawmill operations in all commercial forest types of Montana, Idaho, and northeastern Washington. Costs for 1938 not available until April 15, 1939.

ACCOMPLISHMENTS OF PAST YEAR: In 1937 the weighted averaged cost of milling (from pond to car) was \$13.36, which has never been exceeded since cost records started in 1916 except in 1921 when a comparable cost was \$13.81. It is expected that the 1938 cost will be slightly higher than 1937 costs, not because of any increase in wages or materials but because of curtailed production.

PLANS FOR 1939: Continue project.

DATE OF COMPLETION: Continued indefinitely.

ASSIGNMENT: P. Neff, Regional Logging Engineer,
I. V. Anderson.

SELLING VALUE STATISTICS - LUMBER AND OTHER TIMBER PRODUCTS

FIELD DIVISION: Forest Products

WORK PROJECT: Forest Products Statistics

LINE PROJECT: Statistics on the selling value of lumber and other timber products.

PURPOSE OF WORK: To collect and present in usable form lumber and timber products price statistics for northern Idaho, eastern Washington, and Montana in sufficient volume to indicate periodic trends in selling price of lumber (wholesale and retail), stumpage, logs, cedar products, and ties. These data are used in appraising the stumpage value of timber sold from Forest Service and Indian Service lands of the Inland Empire.

REVIEW OF PAST WORK: Publications are now available to practicing foresters, the lumber industry, and other interested agencies, showing (1) stumpage prices obtained by Inland Empire timber owners by species for each year since 1912; (2) average annual wholesale lumber selling price for each year since 1913 for the commercially important species of the Inland Empire; and (3) records on the selling price of sawlogs, cedar posts and poles, and ties are also available by years back to 1921.

ACCOMPLISHMENTS DURING PAST YEAR: The decline in wholesale lumber prices started during the last three months of 1937 and continued during 1938 until December when demand strengthened to stop the decline. Average for western white pine was \$32.15 for 1938, a drop of \$1.63. The December 1938 average was \$28.82 per M.

Revised publication showing wholesale lumber selling values of Inland Empire species since 1913 to include 1937 figures.

PLANS FOR 1939: Continue project.

DATE OF COMPLETION: Continued indefinitely.

ASSIGNMENT: E. F. Rapraeger on stumpage prices;
M. E. Bouchard to others.

INVENTORY PHASE OF FOREST SURVEY

FIELD DIVISION: Forest Survey

WORK PROJECT: Forest Survey

LINE PROJECT: 1. Inventory Phase of Forest Survey in the Northern Rocky Mountain Region.

PURPOSE OF WORK: A comprehensive inventory of the forests of this Region as part of the Forest Survey of the Nation.

REVIEW OF PAST WORK: Field work on this project was started in 1932. Basic statistical data published for all northeastern Washington and 4 of 10 North Idaho counties. Two-inch-to-mile township plat type maps and one-inch-to-mile unit type maps prepared for 16 million of the 23 million acres mapped to January 1, 1938. The degree of completion for all phases of the inventory based on the ratio of the area mapped to the total regional forest area was 41 percent as of January 1, 1938.

ACCOMPLISHMENTS DURING PAST YEAR: The degree of completion of this phase of the Survey was raised from 41 to 49 percent. Inventory statistics were compiled and reports were released for the 6 remaining Idaho counties. Check cruising was completed in 2 additional western Montana counties. In Flathead County 2,160 M acres were mapped. Ownership status was collected for 3 Montana counties. Progress on compilation work in Lincoln County advanced to 20 percent. Other work not reflected in the progress of the inventory consisted of compilation of type and volume summaries for North Idaho report; segregation of type and volume statistics for North Idaho by individual National Forests; segregation of deforested lands in North Idaho by commercial and non-commercial forest land; preparation of sawlog stand tables for 3 northeastern Washington and 7 Idaho counties; computation of cubic volumes and recomputation of board foot volumes for Idaho County from modified normal yield tables. Two new unit maps and 80 new township maps were issued. Supplied requests for 104 unit maps and 300 township maps of which 90% were hand colored. Contributed 1.3 man-months of compiling and drafting to other Station divisions and supplied numerous requests for special statistical data.

PLANS FOR 1939: (1) Concentration on statistical data for North Idaho Report. This will consist of computation of cubic foot volumes and recomputation of board foot volume of nonsawlog stands in 9 counties; conversion of board foot volume in sawlog stands to cubic feet. Segregation of sawlog volumes by diameter class. Preparation of tables, charts, and maps. (2) Continue drafting and compilation to release maps for 7 million acres and statistics for 8,999 M acres that have been mapped in Montana, for which no information has been released, as rapidly as work on North Idaho Report permits. Inventory and map 3,100 M acres of forest land in Missoula and Ravalli Counties in western Montana.

DATE OF COMPLETION: On the basis of 1939 fiscal year allotments, it is estimated that the Regional project will be completed by 1944.

ASSIGNMENT: M. Bradner, P. D. Kemp, S. B. Hutchison, W. L. Royer, H. B. Hawk, R. L. Conn, and M. E. Metcalf.

January 1939

GROWTH PHASE OF THE FOREST SURVEY

FIELD DIVISION: Forest Survey

WORK PROJECT: Forest Survey

LINE PROJECT: 2. Growth and Yield. Growth Phase of the Forest Survey in the Northern Rocky Mountain Region.

PURPOSE OF WORK: To determine the growth rates in old stands and on restocking areas in the probable future yield.

REVIEW OF PAST WORK: Normal yield tables available for ponderosa pine (R-6), white pine, and lodgepole pine. Made larch-Douglas fir normal yield table. Made cubic-foot volume tables for western larch. Made stocking correlation studies of normal yield tables for northeastern Washington and North Idaho types. Completed normal yield table growth correction factor studies for the ponderosa pine type of northeastern Washington and North Idaho and initiated similar field work for the white pine types. Constructed form class and taper curves of western red cedar poles. Completed 50 percent of the field work of the cedar pole increment study.

ACCOMPLISHMENTS DURING PAST YEAR: (1) Developed normal yield table growth correction factors for the major forest types of northeastern Washington and North Idaho. (2) Completed field work and 95 percent of the office work of the cedar pole increment study. (3) Published Applied Forestry Note No. 88, describing a new method of estimating lengths of cedar poles. (4) Predicted current annual growth for northeastern Washington. (5) Completed 80 percent of current annual growth computation for the North Idaho counties.

PLANS FOR 1939: (1) Completion of cedar pole increment study with final report by February 1, 1939. (2) Compilation of current annual growth estimates for North Idaho with final growth report by April 1, 1939. (3) Continuation of normal yield table application studies for forest types of western Montana.

DATE OF COMPLETION: Assuming funds equal in amount to those provided last year are made available in the future, field work should be completed in F.Y. 1942.

ASSIGNMENT: L. J. Cummings
M. Bradner

A STUDY OF FOREST DEPLETION FROM ALL CAUSES

FIELD DIVISION: Forest Survey

WORK PROJECT: Forest Survey

LINE PROJECT: 3. Depletion. A study of forest depletion from all causes in the Northern Rocky Mountain Region.

PURPOSE OF WORK: To determine as part of the National Forest Survey the average annual forest depletion from cutting, fire, insects, and disease within the Region.

REVIEW OF PAST WORK: Cutting depletion figures collected, compiled and published for entire Region. Compiled lumber depletion statistics for 1935 and 1936 as supplement to cutting depletion report. Field work on fire depletion partially completed for northeast Washington and North Idaho. Collected fire damage and loss data on 6.8 million acres in western Montana. Insect loss survey covering North Idaho 50 percent complete. No work done on disease losses.

ACCOMPLISHMENTS DURING PAST YEAR: Compiled lumber depletion statistics for 1937 as a supplement to the cutting depletion report. Determined the average annual fire depletion losses for the three northeastern Washington counties and did 60 percent of the work to furnish similar data for North Idaho. Collected fire damage and loss data on 2 million acres in western Montana. Obtained the epidemic insect losses for the North Idaho unit. Made arrangements for obtaining white pine blister rust losses.

PLANS FOR 1939: Keep up to date the lumber depletion statistics. Complete the job of determining the average annual fire depletion losses for the North Idaho unit. Continue to collect fire damage and loss figures in western Montana and start compilation and analysis of these data. Obtain complete data on white pine blister rust losses.

DATE OF COMPLETION: 1940.

ASSIGNMENT:
M. Bradner
P. Kemp
S. B. Hutchison
L. J. Cummings

January 1939

STUDY OF PRESENT AND FUTURE REGIONAL REQUIREMENTS
FOR FOREST PRODUCTS

FIELD DIVISION: Forest Survey

WORK PROJECT: Forest Survey

LINE PROJECT: 4. Requirements. A study of present and future regional requirements for forest products.

PURPOSE OF WORK: As a part of the National Forest Survey to determine the current needs for forest products based on present consumption and the trends in use of such products and the underlying causes for such trends.

REVIEW OF PAST WORK: Collected basic data concerning consumption of timber products by railroads, remanufacturing industries, public utilities, the mining industry, Federal agencies, counties, States, and for farm and urban construction, including also the consumption of fuelwood and fence posts. Reports written on (1) rural and urban fuelwood consumption, and (2) fence post consumption. These reports include an analysis of the factors influencing consumption.

ACCOMPLISHMENTS DURING PAST YEAR: Additional data collected for railroad, highway, and Federal agency timber requirements. Analysis and reports on requirements of mining industry, farm construction, power and communication systems. Data compiled and analyzed concerning distribution of lumber from Region. Project 95 percent complete.

PLANS FOR 1939: Analysis and reports for urban, railroad, remanufacturing industries, county, State, and Federal requirements. Presentation of these industrial requirements studies in a single report for publication. Project to be completed early in 1939.

DATE OF COMPLETION: 1939.

ASSIGNMENT: M. Bradner
C. N. Whitney
S. B. Hutchison

January 1939

ECONOMIC ANALYSIS OF FOREST SURVEY DATA IN REPORT FORM

FIELD DIVISION: Forest Survey

WORK PROJECT: Forest Survey

LINE PROJECT: 5. Interpretation. An economic analysis of
Forest Survey data in report form.

PURPOSE OF WORK: To make an economic analysis of all Survey data
and prepare final reports by economic units and regions.

REVIEW OF PAST WORK: Preliminary and general analyses made in the
Forest Survey county reports released in connection with the
Inventory Phase.

ACCOMPLISHMENTS DURING PAST YEAR: Necessary compilation of inven-
tory completed and work on requirements, depletion, and growth
brought into final stages for northern Idaho and northeastern
Washington in preparation for comprehensive reports.

PLANS FOR 1939: To gather additional economic data needed for
Forest Resources report for northern Idaho. To prepare Northern
Idaho Forest Resources report covering all phases of the For-
est Survey correlating and analyzing all data presented. To
inaugurate a special study on the economic dependency of certain
forest communities in northern Idaho.

DATE OF COMPLETION: Complete Northern Idaho Forest Resources
report 1939. Completion date of other reports indefinite.

ASSIGNMENT: M. Bradner
Forest Survey staff

PERIODIC ADJUSTMENTS OF BASIC STATISTICS

FIELD DIVISION: Forest Survey

WORK PROJECT: Forest Survey

LINE PROJECT: 6. Keeping findings current. Periodic balance of timber books. Current information on forest situation.

PURPOSE OF WORK: To currently maintain records of changes in forest inventory due to fire, logging, and other depletion, making periodic adjustments of data considering drain and growth and making re-inventories over longer periods. To keep information on consumption, depletion, and economic factors up to date.

REVIEW OF PAST WORK: Records of fires and logging collected annually from State Forester and National Forests for all public and private lands in northern Idaho. Paper adjustments made on basis of these records without field examination for several county reports. Annual fire depletion records obtained for northeastern Washington and Montana. Annual record of commercial timber production kept by counties for entire Region.

ACCOMPLISHMENTS DURING PAST YEAR: Above data collected for year 1937 and inventory statistics adjusted for six county reports released during year.

PLANS FOR 1939: To collect 1938 fire and logging records for Region and record of logging since type mapping and prior to 1938 for northeastern Washington and Montana. Make adjustments for the Northern Idaho Forest Resources Report. It is planned to preserve in this State Report the type and ownership status as originally compiled even though this may show currency varying from 1932 to 1934. Volumes will be shown both as of the time the Survey was completed and as of January 1, 1939, for all counties by striking a final net balance considering growth and all depletion losses, for National Forest lands and all other lands.

DATE OF COMPLETION: A continuous project.

ASSIGNMENT: Forest Survey staff.

FLOOD CONTROL SURVEYS

FIELD DIVISION: Flood Control Surveys

WORK PROJECT: Flood Control Surveys

LINE PROJECT: Preliminary examinations to determine existence of flood problems.

PURPOSE OF WORK: To make preliminary examinations of watersheds to determine existence of flood problems, as specified by the Flood Control Act of 1936, as amended.

REVIEW OF PAST WORK: Project initiated fall of 1937. Appointment of flood control committee, joint public hearings on Spokane River and Yellowstone River drainages. Some preliminary work done on Spokane River preliminary report.

ACCOMPLISHMENTS DURING PAST YEAR: Completed Spokane River watershed preliminary flood control report in cooperation with Bureau of Agricultural Economics and Soil Conservation Service. Attended joint public flood control hearings held in cooperation with U. S. Army Engineers on Clarks Fork, Colville, and Kootenai (Idaho) River watersheds. Some collection of flood damage and other data on Clarks Fork, Colville, and Kootenai River drainages.

PLANS FOR 1939: Complete preliminary examination reports on Kootenai (Idaho) and St. Regis (part of Clarks Fork) River watersheds. If funds available after June 30, 1939, complete preliminary reports on Colville (Washington) River and one drainage of Upper Missouri watershed.

DATE OF COMPLETION: Continuing. Dependent upon allotment flood control funds.

ASSIGNMENT: V. H. Hougen to May 1938
M. Bradner, in cooperation with representatives of Bureau of Agricultural Economics, Soil Conservation Service, and other cooperating agencies of the Department.

PUBLICATIONS

I. FOREST CONSERVATION

A. Reforestation Methods

B. Forest Management

Effect of the forest industry to soil conservation.
By J. W. C. Brown. Northwest Science, November 1938.
Vol. 12, no. 4, pp. 81-86.

Reforestation methods in the western white pine forests.
By J. W. C. Brown. Southern Idaho Forester, (Pocatello)
Vol. 2, no. 2, pp. 29-31.

Forest fire danger. By H. T. Claborn.
Vol. 29, pp. 27-31.

Forest fire danger. By Leo Shuman.
Vol. 38, no. 2267, pp. 401-02.

Forest fire danger. By Leon C. Hurtt.
Vol. 39, no. 11.

Forest fire danger in Montana. By Leon C. Hurtt.
Vol. 39, no. 11.

APPENDIX

Forest development in the northern rocky mountain region.
By I. V. Anderson and George Duncan. The Timberman,
January 1938. Vol. 39, no. 3, pp. 12-15.

A handy tool for pole road construction. By I. V. Anderson.
The Timberman, August 1938. Vol. 39, no. 4, pp. 34, 36.

Lumber production for the northern rocky mountain region.
By I. V. Anderson. Journal of Forestry, May 1938.
Vol. 36, no. 5, pp. 504-06.

Isn't white pine logical? By E. F. Rappenger.
Forest and Wildlife Quarterly (Univ. Washington), March 1938.
Vol. 11, no. 2, pp. 22-24.

Results and application of a logging and milling study
in the western white pine type of northern Idaho.
By E. F. Rappenger. Univ. Idaho bull. 33, no. 18,
July 1938, 65 pp.

Some facts about knots - how they are formed.
By E. F. Rappenger. The Timberman, August 1938.
Vol. 39, no. 10, pp. 12-13.

PUBLICATIONS

I. PUBLISHED DURING 1938

A. Departmental Bulletins

None.

B. OUTSIDE PUBLICATIONS

Relation of the forest industry to soil conservation. *Silv*
By Kenneth P. Davis. Northwest Science, November 1938.
Vol. 12, no. 4, pp. 81-86.

Weedings and thinnings in the western white pine forests. *Silv*
By Kenneth P. Davis. Southern Idaho Forester. (Pocatello)
Spring issue, 1938. Vol. 2, no. 2, pp. 28-31

Determination of normal fire danger. By H. T. Gisborne. *Fire*
The Ames Forester, 1938. Vol. 29, pp. 27-31.

Measurements of forest fire danger. By Leo Shames. *"*
Science, October 1938. Vol. 88, no. 2287, pp. 401-02.

Cheatgrass range for horses. By Leon C. Hurtt. *Range*
The Montana Farmer, February 1, 1938. Vol. 25, no. 11,
pp. 5-6.

Spineless cactus winterkills in Montana. By Leon C. Hurtt. *"*
Journal American Society of Agronomy, April 1938.
Vol. 30, no. 4, pp. 356-7.

Power saw development in the northern rocky mountain region. *Product*
By I. V. Anderson and George Duncan. The Timberman,
January 1938. Vol. 39, no. 3, pp. 12-15.

A handy tool for pole road construction. By I. V. Anderson. *"* ✓
The Timberman, August 1938. Vol. 39, no. 4, pp. 34, 36.

Lumber production for the northern rocky mountain region. *"* ✓
By I. V. Anderson. Journal of Forestry, May 1938.
Vol. 36, no. 5, pp. 504-06.

Isn't cubic measure logical? By E. F. Rapraeger. *"*
Forest Club Quarterly (Univ. Washington), March 1938.
Vol. 11, no. 2, pp. 22-24.

Results and application of a logging and milling study *"*
in the western white pine type of northern Idaho.
By E. F. Rapraeger. Univ. Idaho bull. 33, no. 16,
July 1938, 55 pp.

Some facts about knots - how they are formed. *"*
By E. F. Rapraeger. The Timberman, August 1938.
Vol. 39, no. 10, pp. 16-18.

Taking the guess out of cedar pole inventories. By L. J. Cummings, Richard M. Varney and Robert E. Swanson. Applied Forestry Note no. 88, November 1938. (Mimeographed) *Survey* Also published as "Eliminating guesswork in cedar pole inventories" in The Timberman, December 1938. Vol. 40, no. 2, pp. 49-53. (No author shown.)

A century of lumbering in northern Idaho. By S. Blair Hutchison. The Timberman, August, September & October, 1938, Vol. 39, nos. 10, 11, and 12. *Survey*

C. MULTILITHED AND MIMEOGRAPHED PROGRESS REPORTS

A guide to Deception Creek Experimental Forest. By Division of Silvics. January 1938. Multilithed. 10 pp. *Silv*

Album of stand improvement practice in the western white pine type. By Kenneth P. Davis. February 1938. "

Natural regeneration in the western white pine type. By Kenneth P. Davis. April 1938. Mimeographed. (Summary of manuscript by Haig, Davis and Weidman to be published as a USDA technical bulletin.) "

Brushfield reforestation in the St. Joe National Forest, Idaho. By C. S. Schopmeyer. Applied Forestry Note no. 83. February 1938. Mimeographed. "

The character of the 1938 fire season in region one. By H. T. Gisborne. Applied Forestry Note no. 87. November 1938. Mimeographed. *Fire*

The character of the 1937 fire season in region one. By H. T. Gisborne. Applied Forestry Note no. 82. February 1938. Mimeographed. "

The northern rocky mountain fire danger meter no. 5. By H. T. Gisborne. Applied Forestry Note no. 85. May 1938. Mimeographed. "

An instance of insect damage resulting from zero-margin selective cutting of ponderosa pine. By J. C. Evenden. Applied Forestry Note no. 84. April 1938. Mimeographed. *Silv*

Results of sawmill study made at J. Neils Lumber Company, Libby, Montana, in 1937. By E. F. Rapraeger. *Prod*

Production of lumber and timber products in Idaho and Montana, 1937. By C. N. Whitney. Applied Forestry Note no. 86. July 1938. Mimeographed. "

Forest statistics, Latah County, Idaho. By Forest Survey staff. Forest Survey release no. 10. *Survey*

Forest statistics, Shoshone County, Idaho. By Forest Survey staff. Forest Survey release no. 11. "

Forest statistics, Nez Perce County, Idaho. By Forest
Survey staff. Forest Survey release no. 12.

Survey

Forest statistics, Lewis County, Idaho. By Forest
Survey staff. Forest Survey release no. 13.

Forest statistics, Clearwater County, Idaho. By Forest
Survey staff. Forest Survey release no. 14.

Forest statistics, Idaho County, Idaho. By Forest Survey
staff. Forest Survey release no. 15.

II. ESTIMATE OF DEPARTMENTAL PRINTING NEEDS FOR OUTSIDE PUBLICATIONS

A. Formal Manuscripts to be Submitted for Departmental Publication Prior to June 30, 1939

Daily variations of some meteorological and fire danger factors by altitude and aspect. By G. L. Hayes. Estimated 60-page manuscript to be submitted to Monthly Weather Review.

The effect of certain chemical attributes of vegetation on forest inflammability. By Leon W. Richards. Submitted to Journal of Agricultural Research.

Drought, a decisive but underrated factor in management of northern Great Plains ranges. By Leon C. Hurtt. Approximately 35-40 page manuscript proposed for U. S. Dept. Agric. technical bulletin.

Forest resources of northern Idaho. By Forest Survey staff. Approximately 50 pages. To be submitted for U. S. Dept. Agric. miscellaneous publication.

B. Formal Manuscripts to be Submitted for Departmental Publication During F.Y. 1940

Natural regeneration in the western white pine type. By Irvine T. Haig, Kenneth P. Davis, and R. H. Weidman. Manuscript of 289 pages proposed for U. S. Dept. Agric. technical bulletin.

Racial influences in a 25-year test of ponderosa pine. By R. H. Weidman. Manuscript of 71 pages submitted to Journal of Agricultural Research.

Growth after logging in the western larch-Douglas fir forests of northwestern Montana. By C. A. Wellner and C. L. James. Manuscript of approximately 75 pages proposed for U. S. Dept. Agric. circular.

A comparison of methods of quadrating short-grass vegetation. By Lincoln Allison. Probably Journal of Agricultural Research.

A plot transection device for measuring extent of range vegetation. By Leon C. Hurtt and _____. Perhaps Ecology or Journal of Forestry.

III. ARTICLES AND OTHER MANUSCRIPTS PROPOSED FOR OUTSIDE PUBLICATION
DURING C.Y. 1939

Controlled burning in the western white pine type.
By Kenneth P. Davis and Karl A. Klehm. Accepted for publication in Journal of Forestry.

Survival in forest plantations in the Northern Rocky Mountain region. By Clifford S. Schopmeyer. To be submitted to Journal of Forestry.

Direct seeding methods in the Northern Rocky Mountain region. By Clifford S. Schopmeyer. To be submitted to Journal of Forestry.

Survey of stand improvement practices in the Northern Rocky Mountain region. By Stewart E. Brown. To be submitted to Journal of Forestry.

Measurement of light intensity beneath forest canopies. By Charles A. Wellner. To be submitted to Ecology.

Economic aspects of silvicultural practices in the western white pine type. By Kenneth P. Davis. Journal article.

Altitudinal zoning of factors of fire behavior on north and south aspects. By G. L. Hayes. Estimated 30-page manuscript to be submitted to Journal of Forestry.

Forest pyrology. By H. T. Gisborne. Submitted to Scientific Monthly.

Hornby's principles of fire control planning. By H. T. Gisborne. Submitted to Journal of Forestry.

Range recovery after the 1934-37 drought. By E. J. Woolfolk and W. Luther Norem. Ecology or Journal of Forestry.

Downy brome (cheatgrass) range for horses. By Leon C. Hurtt. Submitted to American Hereford Journal.

A comparison of methods of quadratting short-grass vegetation. By Lincoln Ellison. Probably Journal of Agricultural Research.

A plot transecter device for measuring extent of range vegetation. By Leon C. Hurtt and _____. Perhaps Ecology or Journal of Forestry.

LIST OF PERSONNEL AS OF JANUARY 1, 1932

Bias in selection and measurement of grass. By Lincoln Ellison.
Journal of Forestry or Ecology.

Testing the durability of wood in the Northern Rocky Mountain region. By I. V. Anderson and C. N. Whitney. Probably The Timberman.

Matches from Idaho white pine. By E. F. Rapraeger. For American Forests.

The farm woodlot - a source of permanent income if handled wisely. By I. V. Anderson. University of Montana press.

Development of branches and knots in western white pine. By E. F. Rapraeger. Journal of Forestry.

Possibility of using second-growth western white pine for match plank. By E. F. Rapraeger. The Timberman.

Durability of fence posts from native timber species of the Northern Rocky Mountain region. By I. V. Anderson and C. N. Whitney. Journal of Forestry.

Timber needs of Northern Rocky Mountain region. By S. B. Hutchison. To be submitted as a trade journal article.

A review of the forest situation in northern Idaho. By Forest Survey staff. To be submitted as a trade journal article.

DIVISION OF FOREST AND RANGE PROTECTION

Control

Harry T. Osborne

Behavior

Harry T. Osborne

G. Lloyd Hayes

Vern L. Giles

Bert L. Haines

John E. Thompson

LIST OF PERSONNEL AS OF JANUARY 1, 1939

DIVISION OF RANGE MANAGEMENT

Elton E. Bentley, In Charge
 Henrietta A. Pickett

OVERHEAD ADMINISTRATION

Melvin I. Bradner, Acting Director	85%
Mary J. Pershina	75%
Norman H. Larsen	
Dagmar Duncan	95%
Marie Bouchard	25%

FIELD STATIONS

Deception Creek Experimental Forest:	Elton E. Bentley
	John D. Crowe
Priest River Experimental Forest:	Donald G. McKeever
Miles City Experimental Range:	E. Joseph Woolfolk
Vigilante Experimental Range:	Tom E. Brierley

DIVISION OF SILVICULTURE

Kenneth P. Davis, In Charge

Silviculture

Kenneth P. Davis	75%
Charles A. Wellner	70%

Mensuration

Kenneth P. Davis	20%
Stewart E. Brown	30%
George R. Fahnestock	

Regeneration

Kenneth P. Davis	5%
Clifford S. Schopmeyer	
William B. Petersen	

DIVISION OF FOREST FIRE PROTECTION

Harry T. Gisborne, In Charge
 Melvin I. Bradner, In Charge
 Frances Hughes

Control

Harry T. Gisborne	10%
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Behavior

Harry T. Gisborne	90%
G. Lloyd Hayes	
Vern L. Cline	
Bert L. Naiman	

DIVISION OF RANGE RESEARCH

Leon C. Hurtt, In Charge
Henrietta A. Pissot

Grazing Management

Leon C. Hurtt	75%
E. Joseph Woolfolk	
Tom E. Brierley	
George H. Gable	
Clark E. Holscher	
Anthony B. Evanko	75%
Robert W. Collins	

Artificial Revegetation

Leon C. Hurtt	25%
Laurence R. Short	
W. Luther Moren	
Anthony B. Evanko	25%

DIVISION OF FOREST PRODUCTS

Irvin V. Anderson, In Charge

Timber Harvesting and Conversion

Irvin V. Anderson	70%
Elmer F. Rapraeger	80%

Wood Preservation

Chester N. Whitney	30%
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Forest Products Statistics

Irvin V. Anderson	30%
Elmer F. Rapraeger	20%
Chester N. Whitney	70%
Marie E. Bouchard	75%

DIVISION OF FOREST SURVEY

Melvin I. Bradner, In Charge
Frances Hughes

Inventory

Melvin I. Bradner	5%
Paul D. Kemp	60%
Jess M. Honeywell	
William L. Royer	
Robert L. Conn	
Melvin E. Metcalf	
Howard B. Hawk	
John B. LaCasse	

Growth and Yield

Laurence J. Cummings
Richard M. Varney
Henry J. Pissot

Y. Y. 1939

90%

Depletion

Paul D. Kemp

Indirect Project : Direct Project :
Costs : Costs : Total Costs
(Overhead) :

20%

Requirements

S. Blair Hutchison

3,536

20%

24,154

27,690

Analysis and Preparation of Results

Melvin I. Bradner

10%

13,050

S. Blair Hutchison

80%

22,241

Paul D. Kemp

20%

Laurence J. Cummings

10%

14,403

12,997

FLOOD CONTROL SURVEYS

Edna Morrison

760

7,243

13,363

100,237

WESTERN RANGE SURVEY

Dagmar Duncan

5%

DISTRIBUTION OF DIRECT COSTS BY MAIN PROJECTS

F. Y. 1939

DIRECT AND INDIRECT COSTS BY FINANCIAL PROJECTS

F. Y. 1939			
Financial Project	: Indirect Project	: Direct Project	:
	: Costs	: Costs	: Total Costs
	: (Overhead)	:	:
Forest Management	\$ 3,596 13	\$ 24,154	\$ 27,750
Range Research	5,348 16	27,552	32,900
Forest Products	none 0	12,050	12,050
Forest Survey	<u>5,659 11</u>	<u>29,241</u>	<u>34,900</u>
TOTAL	14,603 33	92,997	107,600
Flood Control Surveys	<u>760 10</u>	<u>7,240</u>	<u>8,000</u>
GRAND TOTAL	15,363 43	100,237	115,600

FOREST PROJECTS

Timber harvesting and conservation	50	55	250	9,082	7,410
Wood preservation			10	700	720
Forest products statistics		500		3,430	3,930
TOTAL	50	555	270	11,175	12,060

FOREST SURVEY

Survey of forest resources, etc.	400	244	2,645	18,412	5,919	29,241
FLOOD CONTROL SURVEYS	500	145	1,000	4,525	1,350	7,240

DISTRIBUTION OF DIRECT COSTS BY MAIN PROJECTS

INCREASES F. Y. 1939

Although it would be : Cars, ab: Seien-: Travel : :
: mainte-: tific : expenses: Salaries :
Financial and Work Project : nance, : equip-: other : :
: & new : ment, : than : Regular:Temporary: Total
established at this Station: there : etc. : cars : projects : :

FOREST MANAGEMENT

Silviculture	25	500	800	4,712	810	6,847
Mensuration	25	100	700	2,611	810	4,246
Regeneration	25	31	100	150	526	832
Forest fire protection	50	49	690	9,980	1,460	12,229
TOTAL	125	680	2,290	17,453	3,606	24,154

RANGE RESEARCH

Grazing Management	200	1,139	1,075	13,803	3,995	20,212
Artificial revegetation	100	540	500	6,000	200	7,340
TOTAL	300	1,679	1,575	19,803	4,195	27,552

FOREST PRODUCTS

Timber harvesting and conversion	50	55	253	7,052		7,410
Wood preservation			20	700		720
Forest Products statistics		500		3,420		3,920
TOTAL	50	555	273	11,172		12,050

FOREST SURVEY

Survey of forest resources, etc.	400	864	3,645	18,413	5,919	29,241
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FLOOD CONTROL SURVEYS

	200	165	1,000	4,525	1,350	7,240
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OLD ESTABLISHED LINES OF WORK

ok

: Amount Increase :

Field Division, Work Project and Line Project : Needed

INCREASES NEEDED FOR NEW RESEARCH

FOREST MANAGEMENT RESEARCH

Although it would be preferable to concentrate for the present on building up and adequately financing the major lines of work already established at this Station, there are a number of new projects and new fields in which work, even if on a small scale, should be initiated. We, ourselves, are in need of and are being called upon for information on forest and range influences, range resources and conditions, and on the economics of the situation in the lumber and livestock industries.

There are tabulated below the appropriation increases necessary to build up the old established lines of work to a point where the Station can redeem its responsibility as the foremost research agency within the Region and those needed to initiate new projects and lines of work.

<u>Timber Acquisition & Conversion</u>	3,000	1
<u>Regional Wildlife-Use Species Problems</u>	5,000	2
<u>IMPROVEMENT CONSTRUCTION</u>	140,000	1
<u>IMPROVEMENT MAINTENANCE</u>	5,000	2

<u>Recreation of Forest Area to Agriculture</u>	12,000	1
<u>Recreation of Wildlife and Forestland</u>	12,000	2

of

OLD ESTABLISHED LINES OF WORK

	: Amount Increase :	
Field Division, Work Project and Line Project :	Needed	Priority

FOREST MANAGEMENT RESEARCH

Forest Fire Research

Fire Control Planning	\$ 10,000	1
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Silviculture

Management White Pine	5,000	1
Mensuration	8,000 ✓	1
Management Other Types	15,000	2
Regeneration	7,000	3

RANGE RESEARCH

Grazing Management

Summer Ranges	15,000	1
Spring-Fall Ranges	10,000	2

Artificial Revegetation

Improved Range Plants	10,000	2
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FOREST SURVEY

	50,000	1
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FOREST PRODUCTS

Timber Harvesting & Conversion	5,000	1
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Regional Little-Use Species Problems	5,000	1
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IMPROVEMENT CONSTRUCTION	142,000	2
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IMPROVEMENT MAINTENANCE	6,000	1
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Relation of Forest Cover to Streamflow	15,000	1
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Relation of Woodland and Grassland Cover to Streamflow	15,000	2
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Statements and justification sheets for the increases for the projects and lines of work follow.

ok

FIELD DIVISION:

NEW PROJECTS AND LINES OF WORK

	: Amount Increase :
Field Division, Work Project and Line Project :	Needed : Priority

FOREST MANAGEMENT RESEARCH

Forest Fire Protection

Behavior - Rate of Spread \$ 15,000 1

RANGE RESEARCH

Grazing Management

Western Range Survey 25,000 1

Artificial Revegetation

out Breeding, Adaptation, and Methods of
Establishment of Improved Range Plants 30,000 3

FOREST ECONOMICS

Private Forestry

Financial Aspects in the White Pine
Type of Northern Idaho 15,000 1

Range Economics

Range Economics 10,000 2

FOREST AND RANGE INFLUENCES

Influence of Natural Vegetation on Streamflow

Relation of Forest Cover to Streamflow 15,000 1

Relation of Woodland and Grassland
Cover to Streamflow 15,000 2

Statements and justification sheets for the increases for the new projects and lines of work follow.

JUSTIFICATION FOR APPROPRIATION INCREASE

FIELD DIVISION: Forest Management

WORK PROJECT: Forest Fire Protection

LINE PROJECT: Fire Behavior - Rate of Spread

An annual allotment of at least \$15,000 extended over a period of five years is urgently needed to determine accurately the rate of spread of fire through each of the many different timber and fuel types of the Northern Rocky Mountain Region under each of the several broad classes of weather that may and do prevail annually.

To conduct such research properly, at least two high caliber men and several assistants will be needed. The leaders must be thoroughly experienced in forest fire behavior in order to minimize the personal danger and must in addition be well trained in physics and meteorology, the two sciences basic to a proper understanding and measurement of fire behavior.

These research projects have been copied, initiated, continued, and applied throughout other forest fire regions of the United States by many other agencies including the Park Service, Indian Bureau, and private foresters. The research has therefore been of the highest local value.

One now has exceedingly difficult, even dangerous, problems set in now needed by the thorough investigation of the forest fire problem which had to be handled empirically, or by judgment, in the early years. This is the accurate determination of the rate of spread of fire through each of the many different timber and fuel types.

JUSTIFICATION FOR APPROPRIATION INCREASE

Fire Behavior - Rate of Spread

region under each of the several broad classes of weather that may not do prevent burning.

The fire problem is the basic and most important forest problem throughout the Northern Rocky Mountain Region. Without adequate fire control at reasonable cost the more than 30 million acres of forest land, bearing some 92 billion board feet of merchantable timber, cannot be made to contribute its fullest possible social-economic benefits to this region and to the rest of the country. No other part of the United States is subjected to as many forest fires caused by lightning over a period of years, and few other parts bear a forest growth exposed to a climate more conducive to rapidly spreading fires of equal difficulty of control.

Research by the Northern Rocky Mountain Forest and Range Experiment Station devoted to this problem has already improved the efficiency of fire control very materially. The fire danger meter for measuring forest fire danger and the methods of fire control planning to insure the proper distribution of adequate manpower and facilities have done this. Both of these research results also have been copied, imitated, modified, and applied throughout other forest fire regions of the United States, and by many other agencies including the Park Service, Indian Service, State, and private foresters. The research has therefore been of far more than local value.

One new and exceedingly difficult, even dangerous, research project is now needed by the thorough investigation of one phase of the forest fire problem which had to be handled empirically, or by judgment alone.

An annual allotment of at least \$15,000 will be required for this work for a period of about five years.

This is the accurate determination of rates of spread of fire through each of the many different timber and fuel types of this

FIELD DIVISION:

region under each of the several broad classes of weather that may and do prevail annually.

Accurate determination of the probable rate of spread of each new fire obviously is essential to the decision as to how many men and how much equipment shall be sent to that fire. Too many men and too much equipment result in unnecessary expense as well as danger to other parts of the area by reducing the force and equipment in reserve. Sending too few men and inadequate equipment has, too often in the past, resulted in great losses of timber destroyed and extremely large costs for final suppression of the fire that thereby escaped initial control.

By systematic measurements on actual fires and by the use of experimental or test fires the needed information can be obtained in the course of a few seasons. Without such research dependence must be placed upon mass analysis of ordinary fire reports, incomplete in many respects - especially the weather conditions at the fire, inherently inaccurate in some respects due to the labor-type of men used as smokechasers and often the only men at the fire in its early stages, and inadequate in that the worst fuel types producing the smallest number of fires yet by far the largest proportion of area burned will be represented by so few reports that a long period of years must elapse before even moderately dependable conclusions can be drawn.

An annual allotment of at least \$15,000 will be required for this work for a period of about five years.

23 million acres of range land on which field surveys have not yet been made.

FIELD DIVISION: Range Research

WORK PROJECT: Grazing Management

LINE PROJECT: Western Range Survey

clerks with range survey experience, and draftsmen are needed. The

An allotment of \$25,000 annually, extending over a period of 6 years, is urgently needed to continue the Cooperative Western Range Survey project discontinued in July 1938.

A detailed inventory of the location, extent, values, and present condition of the grazing resources is necessary to determine those management and betterment practices which are essential for the proper development, conservation, and use of the range lands for the social and economic welfare of the Region.

Range surveys have now covered 42 million acres, or around 65 percent, of all range lands in the Region. About 32 million acres of these range surveys were done during the past three years mainly under the AAA program or by the Farm Security Administration and Soil Conservation Service. Range surveys of some 10 million acres of National Forest land have also been made to date. The Cooperative Western Range Survey project, while active, completed the drafting of grazing surveys, maps, and tabulated the grazing capacity by sections on approximately $7\frac{1}{2}$ million acres of range land situated in 10 eastern counties. Thus, compilation work has only been completed on 23 percent of the 32 million acres of private and public land, on which range survey data are already available. The work of compiling, placing on maps, and analyzing the data on the National Forest range surveys is being done currently. There still remains some 23 million acres of range land on which field surveys have not yet been made.

In order to carry out this work efficiently, a high caliber project leader, two first class assistants, and a number of statistical clerks with range survey experience, and draftsmen are needed. The project leader should be well trained in the technique and methods used in range surveys and should have a wide knowledge of range conditions within the Region. The two assistants should be junior range examiners with some experience on range surveys.

of the total land area in all States of Federal, State, county, and private ownership. The range resources, in Montana particularly, occupy a key position in any general adjustment and conservation program for the West.

A detailed inventory of the location, extent, value, and present condition of the grazing resources is necessary to determine these conditions as they exist, to determine the carrying capacity of the range, and to determine the proper management and betterment practices which are essential for the proper development, conservation, and use of the range lands for the social and economic welfare of the region. The basic data made available by such a range inventory can also be used as a guide for the restocking of the drought area and as a basis for equalizing taxation of range lands.

Range surveys have now covered approximately 42 million acres, or 55 percent, of all range lands in this region. Around 22 million acres of these range surveys have been conducted during the past three years mainly under the AAA program or by the Farm Security Administration and Soil Conservation Service. The bulk of these recent surveys have been done on privately owned range land. Range surveys of some 10 million acres of national forest land have also been made to date. The Department of the Interior Western Range Survey project was inaugurated in April 1937 looking towards which have been made, compiled, and reported to date.

the ultimate assembly of a detailed inventory of the range resources
JUSTIFICATION FOR APPROPRIATION INCREASE

throughout the 17 western States. The project was designed to prepare
Western Range Survey

maps and tabulations of all grazing land covered by range surveys for
Livestock production is one of the major industries upon which
the use of ranchers and for land-use planning and by administrative
much of the development and prosperity of the Northern Rocky Mountain
agencies. From these maps and tabulations, together with the written
region has been based. The range lands in this region comprise approxi-
descriptions, the location, extent, kinds, density, and composition
mately 65 million acres, or 60 percent of the total land area in all forms
of the plant cover, the grazing capacity of range areas was to be
of Federal, State, county, and private ownership. The range resources, in
worked out. The project at this Station was organized to cover the
Montana particularly, occupy a key position in any general adjustment and
Northern Rocky Mountain region (WBA-Region 3). It is a part of a
conservation program for the West.

The Cooperative Western Range Survey project at this Station
A detailed inventory of the location, extent, value, and present
which was initiated in April 1937 and discontinued because of lack of
condition of the grazing resources is necessary to determine those man-
funds on June 30, 1938, completed the drafting of grazing survey
agement and betterment practices which are essential for the proper devel-
and tabulated the grazing capacity by sections on approximately 10
opment, conservation, and use of the range lands for the social and eco-
million acres of range land situated in 10 eastern Montana counties.
nomic welfare of the region. The basic data made available by such a range
The data were analyzed and reports prepared for the 10 counties.
inventory can also be used as a guide for the restocking of the drought
ing up the important range problems in each county with recommendations
area and as a basis for equalizing taxation of range lands.
for improving and conserving the range resources.

Range surveys have now covered approximately 42 million acres,

When the Cooperative Western Range Survey project was dis-
or 65 percent, of all range lands in this region. Around 32 million
tinued on July 1, 1938, there was an estimated 185 million acres of
acres of these range surveys have been conducted during the past three
million in Montana of unasssembled AAA range survey data which were
years mainly under the AAA program or by the Farm Security Administration
ready to be compiled, tabulated, and the data placed on maps. These
and Soil Conservation Service. The bulk of these recent surveys have
The 1938 State range surveys by the AAA and other agencies
been done on privately owned range land. Range surveys of some 10 million
covered an estimated 7 million acres in Montana. This covered
acres of national forest land have also been made to date. The Cooperative
in addition to the 10 million acres of national forest range surveys
Western Range Survey project was inaugurated in April 1937 looking towards
which have been compiled, and mapped to date.

the ultimate assembly of a detailed inventory of the range resources throughout the 17 western states. The project was designed to prepare maps and tabulations of all grazing land covered by range surveys for the use of ranchers and for land-use planning and by administrative agencies. From these maps and tabulations, together with the written descriptions, the location, extent, kinds, density, and composition of the plant cover, the grazing capacity of range areas was to be worked out. The project at this Station was organized to cover the Northern Rocky Mountain region (WRS-Region E).

The Cooperative Western Range Survey project at this Station, which was initiated in April 1937 and discontinued because of lack of funds on June 30, 1938, completed the drafting of grazing survey maps and tabulated the grazing capacity by sections on approximately 7½ million acres of range land situated in 10 eastern Montana counties. The data were analyzed and reports prepared for the 10 counties pointing up the important range problems in each county with recommendations for improving and conserving the range resources.

When the Cooperative Western Range Survey project was discontinued on July 1, 1938, there was an estimated 18½ million acres (15½ million in Montana) of unassembled AAA range survey data which were ready to be compiled, tabulated, and the data placed on maps. During the 1938 field season range surveys by the AAA and other agencies covered an additional 7 million acres in Montana. This coverage is in addition to the 10 million acres of national forest range surveys which have been made, compiled, and mapped to date.

Judging by the present use of WRS material and the numerous requests from many individuals, organizations, and agencies for this information, it is evident that the uniform maps and tabulations, together with the written reports, are being used extensively by livestock operators, state grazing associations, and land-use planning agencies in the administration of individual operating units, grazing association, and public owned range lands. For this reason, the continuation of the work of the Western Range Survey is bound to be an important factor in securing the proper application of a set of land management practices that will reasonably insure the restoration and future maintenance of the soil and range resources at their most productive level.

An allotment of \$25,000 annually for a 6-year period is urgently needed to continue and complete the Western Range Survey in the Northern Rocky Mountain region.

and additional clerical assistance also be needed soon after the project is started.

70
FIELD DIVISION: Range Research

WORK PROJECT: Artificial Range Revegetation *out*

LINE PROJECT: Breeding, Adaptation, and Methods of Establishment
of Improved Range Plants.

An additional allotment of \$30,000 is needed to initiate a new phase of range revegetation to improve production and stability of western ranges through the breeding, adaptation, and development of field methods for promising introduced and improved range plants. The first job is to select and start development of at least one field station suitable for such a project.

A project leader of P-4 or P-5 grade is needed for this work who is qualified by training and experience in genetics, agronomic, and experimental procedure, and who can aggressively develop details of the experimental and physical setup for such a project. A P-2 grade man with a similar type of training and additional clerical assistance will also be needed soon after the project is started.

A successful program of revegetation will also check overstocking and aid in water conservation in a semiarid region. The U.S. Forest Service and land managing agencies are willing to supply information as requested. Material of a general nature is available from State universities. Material of a specific nature is scarce.

FIELD DIVISION: JUSTIFICATION FOR APPROPRIATION INCREASE

WORK PLAN: Range Research - Breeding, Adaptation, Methods, etc. *out*

LINE PROJECT: Financial Aspects in the White Pine Type of

This \$30,000 increase is needed for a comprehensive program of range revegetation research at this Station in 1941 to start development of field stations and test centers for a program of forage plant breeding and adaptation through use of native, introduced, and newly developed forage plants which give promise of increasing present low production on any portion of about 75 million acres of range land of this Region. Field tests and methods must also be worked out for more promising species and mixtures. A large portion of this area is, due to drought, overgrazing, unwise plowing, and other causes, producing at such a low level that there has been a serious loss of population and ranch homes in many places. Better range management, coupled with a program of revegetation that will utilize plant breeding of forage plants to a similar degree as in the case of field crops, should help to reverse present declining trends in population and restore greater social and economic stability of ranch homes still remaining.

A successful program of revegetation will also check accelerated erosion and aid in water conservation in a semiarid region. Even now, private land owners and land managing agencies are calling for specific information on reseeding questions, only a part of which can be supplied from data available. Research is lagging behind demand.

JUSTIFICATION FOR APPROPRIATION INCREASE

Financial Aspects in the White Pine Type of Northern Idaho

FIELD DIVISION: Forest Economics
WORK PROJECT: Private Forestry
LINE PROJECT: Financial Aspects in the White Pine Type of Northern Idaho

An allotment of \$15,000 is needed to initiate a new project for the purpose of studying the financial aspects of forestry in the white pine type of northern Idaho. The purpose of such a study is to determine and demonstrate profitable methods of management of the white pine forests of northern Idaho for the continuous production of commercially valuable forest products and for the highest economic use of the land. The orderly and profitable management of such timber lands requires a comprehensive study to determine (1) the extent of and the specific causes for forest land delinquency; (2) the financial returns to be expected under private, State, and Federal ownership; and (3) the feasibility of sustained yield management for the type.

This allotment will be used to obtain the services of a forest economist in the P-4 grade, who will take charge of the project. An assistant in the P-1 grade, one full-time statistical clerk, and from 12 to 18 man-months of temporary help will also be needed. Traveling expenses, Station overhead, and office supplies will use the balance of the allotment. During F.Y. 1941 funds and personnel will be used most efficiently in collecting information on the tax delinquency phase of the problem and compiling and analyzing the data.

time of this project.

JUSTIFICATION FOR APPROPRIATION INCREASE

Financial Aspects in the White Pine Type of Northern Idaho

Lumbering in the white pine forests of northern Idaho is the major industry and the only support for many communities. The high cost of carrying land, due to heavy fire control costs, timber taxes, costly silvicultural measures necessary to perpetuate the white pine type, and the threat of blister rust damage, seriously challenges the feasibility of a stabilized and permanent forest industry under private ownership. There has been a very rapid and disturbing break-down in private land ownership. Nearly 1/4 million acres of cutover land have passed to the counties through tax delinquency and more than 240,000 acres have been donated to the Federal Government. Cutting in the majority of the white pine stands of northern Idaho has progressed so far that sustained yield management on anything like the present cut is already impossible. As a result, many of the forest communities have become decadent and others are rapidly tending toward that end. The future of the industry is in the balance. All of this in spite of the fact that white pine produces the most valuable lumber of any of our western species.

The orderly management of timber lands in the white pine type requires a comprehensive study to determine (1) the extent of and the specific cause for forest land delinquency; (2) the financial returns to be expected under private, State, or Federal ownership; and (3) the feasibility of sustained yield management for the type.

The allotment of \$15,000 to the Northern Rocky Mountain Forest and Range Experiment Station will be required to properly finance the initiation of this project.

JUSTIFICATION FOR APPROPRIATION INCREASE

FIELD DIVISION: Forest Economics

Forest Economics - Range Economics

WORK PROJECT: Range Economics

LINE PROJECT: Range Economics

For a regional program of research in the field of forest economics an initial allotment of \$10,000 is needed for the fiscal year 1941.

An allotment of \$10,000 is needed to initiate a new project for the purpose of studying the major readjustments away from dry-farming towards more reliance on range livestock production. There is a great need for research data to guide these adjustments so that costly mistakes in future land-use may be avoided.

To initiate such research, a project leader of high caliber, field assistance, and clerical help are needed. The leader must be trained in agricultural economics, preferably one who has given special attention to the economics of both forest and range lands and their relationships with other agricultural problems.

JUSTIFICATION FOR APPROPRIATION INCREASES

Forest Economics - Range Economics

For a regional program of research in the field of range economics an initial allotment of \$10,000 is needed for the fiscal year 1941.

Major readjustments away from dry-farming toward more reliance on range livestock is in progress generally on an area aggregating about 75 million acres of this Region. There is great need for research data to guide these adjustments so that costly mistakes in land use may be avoided. The size of a ranch home unit which will provide a satisfactory standard of living, the hazards of submarginal land ownership, better marketing practices for range livestock, and the best balance in use of range with cropland and feeds, must be carefully evaluated to guide a sound program of developments for succeeding generations.

The requested allotment of \$10,000 will provide for the following: one project leader in the P-5 grade, one assistant in the P-4 grade, one soil expert in the P-3 grade, and three field assistants.

To determine exactly the influence of different types of cover such as forest, brush, and grass in retarding run-off in this region, and to determine the deleterious effect on loss of soil fertility caused by this erosion and run-off, there is needed the proper experimental setup of dams, weirs, hydrometers, and other measuring devices placed in adjacent drainage of adjacent watersheds.

FIELD DIVISION: Forest and Range Influences

WORK PROJECT: Influence of Natural Revegetation on Streamflow

LINE PROJECT: Relation of Forest Cover to Streamflow in the
Western White Pine Type

An allotment of \$15,000 is needed to start this project. The purpose of the project is to determine the comparative influence of forest, brush, and other vegetative cover and bare land, under varying conditions of topography, soil, precipitation, and other factors, in:

- (a) Retarding run-off
- (b) Delivering maximum amounts of usable water
- (c) Preventing destructive floods
- (d) Controlling erosion and consequent downstream silting
- (e) Maintaining soil productivity.

The work at the start will be to select, survey, and map an experimental area embracing comparable and adjoining watersheds, and to plan the location and installation of dams, weirs, lysimeters, meteorological, and other necessary equipment, and also to plan the building of the required physical plant.

The requested allotment of \$15,000 will provide for the following: one project leader in the P-5 grade, one assistant in the P-2 grade, one soil expert in the P-3 grade, and three field assistants.

To determine exactly the influence of different types of cover such as forest, brush, and grass in retarding run-off in this region, and to determine the deleterious effect on loss of soil fertility caused by this erosion and run-off, there is needed the proper experimental setup of dams, weirs, lysimeters, and other measuring devices placed in adjoining drainages of different cover conditions.

JUSTIFICATION FOR APPROPRIATION INCREASE

Relation of Forest Cover to Streamflow in the Western White Pine Type

Northern Idaho and western Montana embrace an important part of the headwaters of the Columbia River. Destructive fires and logging have removed much of the natural forest cover, leaving barren and brush-covered slopes. Under such conditions the heavy rains that frequently come in winter find no green crown canopy to break their force; no duff cover to absorb the excessive downpour. The effect is rapid run-off, resulting locally in soil erosion and swollen conditions of the streams. Major floods, like that of December 1933, when the monthly downpour amounted to 12 inches, do great damage to highways and railroads, destroy bridges and private property. The more important damage, however, comes from the more frequent minor floods, the combined effect of many of which, in the numerous headwater streams of the Columbia, is the vast downstream losses in silting of channels and sedimentation of reservoirs, the largest of which in time will be the Grand Coulee and Bonneville projects.

FOREST AND RANGE INFLUENCES

FIELD DIVISION: Forest and Range Influences

WORK PROJECT: Influence of Natural Vegetation on Streamflow

LINE PROJECT: Relation of Woodland and Grassland Cover to Streamflow

An allotment of \$15,000 is requested to start this project. The purpose of this project is to determine the influence of grass and other vegetative cover, in conjunction with proper range use, in conserving water supplies for irrigation and other purposes and in controlling erosion in eastern Montana.

The work at the start will be to select, survey, and map a suitable experimental area or areas, and to plan the location and installation of equipment for measuring soil erosion, water run-off, and meteorological factors, and also to lay out and plan the fencing of areas for different types of range utilization practices.

The requested allotment of \$15,000 will provide for the following: one project leader in P-5 grade, one assistant in P-2 grade, one soil expert in P-3 grade, and three field assistants.

JUSTIFICATION FOR APPROPRIATION INCREASE

Relation of Woodland and Grassland Cover to Streamflow

The conservation of water supplies for irrigation use and the prevention of run-off and soil erosion that result in very serious sedimentation of reservoirs are of vital importance in the portion of Montana east of the Continental Divide. Among the many storage reservoirs of eastern Montana that suffer from sedimentation and consequent limitation of storage capacity, the largest is that of the Fort Peak project.

The problem in this territory is further complicated by the grazing of livestock which, under the slightest misuse, greatly accelerates run-off and erosion.

Besides existing irrigation projects, heavy expenditures are now being made by various agencies for numerous small irrigation projects, stock water storage, and other water-conserving undertakings in the plains and foothill territory. Studies have not yet been made in this region to serve as a basis for safeguards to these water projects that represent many million dollars invested.

Important questions that require research are:

- (a) What is the comparative effectiveness of tree, brush, and grass cover in controlling run-off in the more mountainous headwater sections of eastern Montana?
- (b) What forage species and what density of cover will provide the best watershed protection in the foothill section?

(c) How can the required density and composition be built up and maintained?

(d) What degree of range use is allowable from an erosion and run-off standpoint?

(e) How can the maximum amount of usable water be delivered where needed?

Under the wide range of conditions in the territory the problem is two-fold and involves study in (1) the mixed forest and glade type of cover at the headwaters of streams forming the important Missouri River drainage system, and (2) the grass and shrubby cover type of the plains and foothills where, under conditions of semi-arid climate and over-utilization of forage, the situation with respect to loss of soil fertility by sheet and gully erosion, and the rapid loss of water through run-off has become particularly acute and constitutes one of the major regional problems.